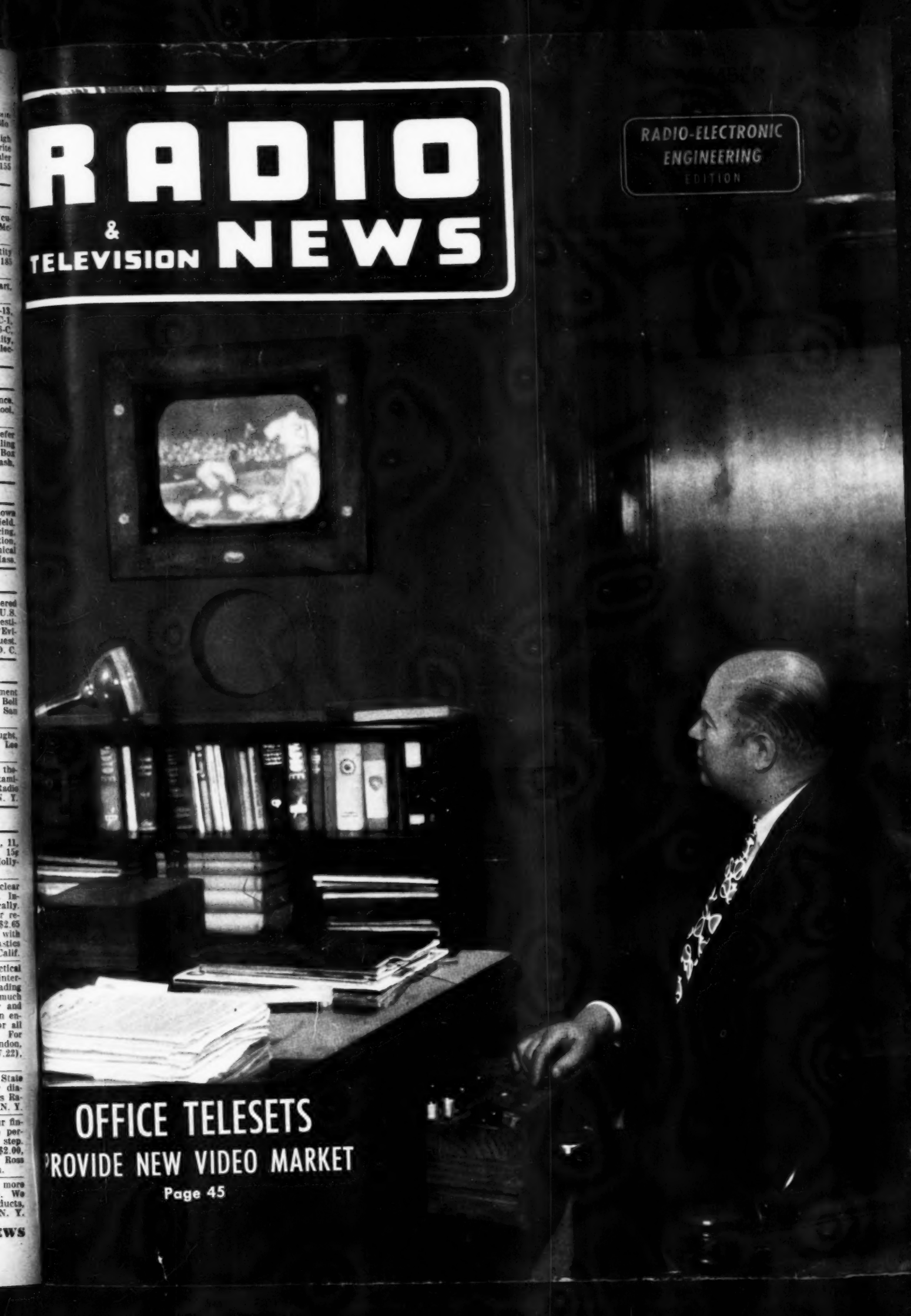
RADIO & TELEVISION NEWS

RADIO-ELECTRONIC ENGINEERING EDITION



OFFICE TELESETS PROVIDE NEW VIDEO MARKET

Page 45

NEWEST

GREATER TV EFFICIENCY WITH NEW "HIGH-LOW" ARRAY BY WARD

Watch WARD

All major parts pre-assembled.
Saves costly installation time.

Here's another "first" by Ward in the rapidly expanding field of television reception. Advanced Ward design and engineering makes receivers work to their highest degree of efficiency.

That's the opinion of satisfied set owners, service installers, and major set manufacturers, who are all directly interested in the improved performance of television.

As a result of months of exhaustive scientific research and field testing, Ward now makes available a high band TV array which can be stacked above the standard television elements, and independently oriented! Also new is a kit for stacking two of Wards finest television assemblies into a two-bay array for a greater gain than ever before.

Sure, there have been other multiple antennas, but none with the scientifically measured spacing and complete adaptability of the new Ward models. You can see the difference yourself on the television screen when a "Magic Wand" aerial is connected to the set.

Send in coupon today for free copy of new Ward catalog.

ORIENTING AND GAIN. Each bay tilts in any plane, can be oriented in any direction to give sharpest focus possible. Eliminates awkward or tricky installations. Permits hairline adjustments for utmost gain on both the high and low band stations.

ADAPTABILITY. Ease of combination of assemblies in basic kits makes "Magic Wand" Aerials more adaptable than ever to the varying requirements of each installation. This superior flexibility means a highly specialized Ward TV aerial for each purpose, with fewer models in stock, no obsolescence, and greater profits! Write today for free catalog!

Please send me free copy of your new catalog showing latest developments in television aerials.
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IN CANADA: ATLAS RADIO CORP. LTD., TORONTO, CANADA

Magic Wand

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BY PRACTICING IN SPARE TIME

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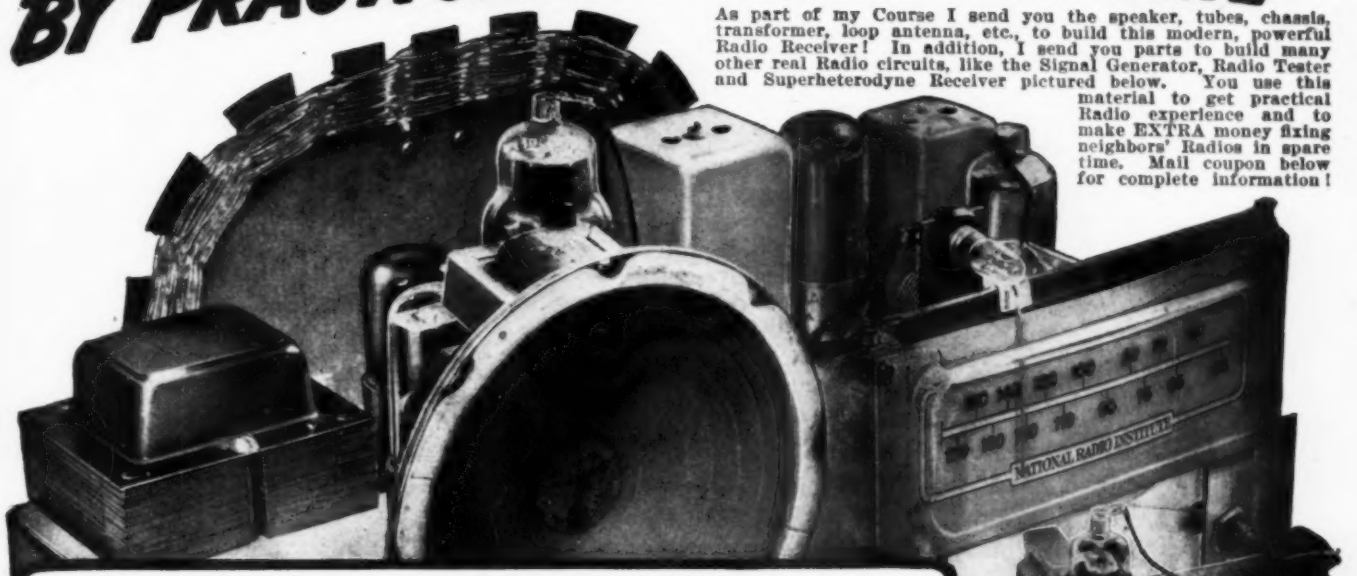

I SEND YOU BIG KITS OF PARTS
You Build and Experiment With this MODERN RADIO
AND MANY OTHER CIRCUITS

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Do you want a good-pay job in the fast-growing Radio Industry—or your own money-making Radio Shop? My train-at-home method has helped hundreds of men with *no previous experience* become qualified Radio Technicians. Mail the Coupon and you'll get a Sample Lesson and my 64-page book, "How to Be a Success in RADIO-Television-Electronics," both FREE. See how you get practical Radio experience at home, building, testing Radio circuits with BIG KITS OF PARTS I send!

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The day you enroll I start sending EXTRA MONEY manuals. You learn Radio principles from my easy-to-understand, illustrated lessons—PRACTICE what you learn with parts I send—USE your knowledge to make EXTRA money fixing neighbors' Radios in spare time while still learning! From here it's a short step to your own *full-time* Radio Shop or a good Radio job!

Future for Trained Men is Bright in Radio, Television, Electronics

It's probably easier to get started in Radio now than ever before, because the Radio Repair Business is booming. Trained Radio Technicians also find profitable opportunities in Police, Aviation, Marine Radio, Broadcasting, Radio Manufacturing, Public Address work. Think of even *greater* opportunities as public demand for Television, FM, Electronic devices continues to grow. Get the facts on all these opportunities. Send for FREE books now!

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Mail Coupon for Sample Lesson, "Getting Acquainted With Receiver Servicing," and my FREE 64-page book. It's packed with facts about Radio's opportunities for you. Read the details about my Course. Read letters from men I trained, telling what they are doing, earning. See how quickly, easily you can get started. No obligation. Just MAIL COUPON NOW in an envelope or paste it on a penny postal.

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COVER PHOTO: Custom television installation at Passaic, New Jersey home office of Allen B. DuMont Laboratories, Inc. Dr. DuMont can control the operation of the set (which provides AM, FM, and short-wave coverage besides video) from a remote control panel in drawer. (Photo by Charles Haacker)

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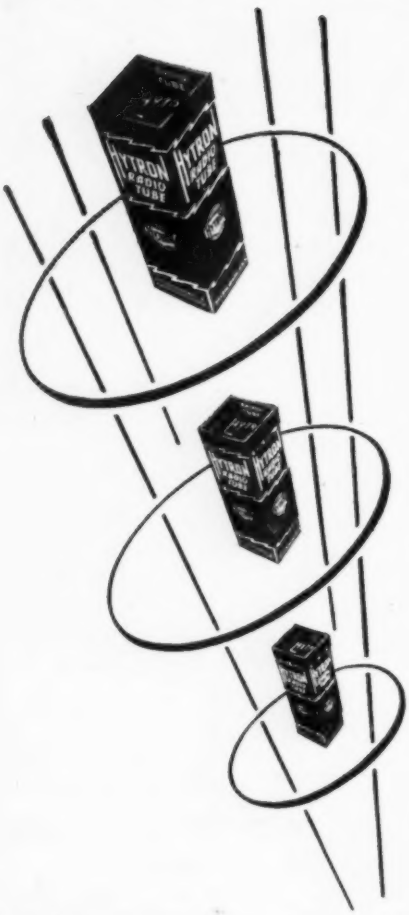
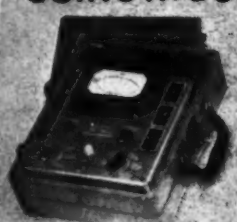
TV and HYTRON go together!



GOING... GOING... GONE!



Last prizes in your Hytron serviceman's contest going-going-gone. Grand prize winner soon to be announced. Contest over. *BUT* the results are just beginning. We are now up to our necks in "hot" ideas. Two swell new shop tools are already scheduled for production. Many more coming. Don't miss a single one. And thanks a million for your cooperation in the contest. We are doing our darndest to make your efforts pay off for you.

TV and tubes go together. A heck of a lot of tubes. Lots of kinds of tubes. Miniature, GT, G, metal, and lock-in. In TV you find all varieties of receiving tubes.

To replace them, you need dependable tubes and a wide range of types. Dependable—because the complex TV tube chain is no stronger than its weakest link. A wide choice of types—to match the ingenuity of TV set designers.

Hytron gives you both. All kinds of tubes—and the same dependable Hytron tubes which keep company with the best of TV set makers. Service *your* TV sets with Hytron tubes; you'll find that TV and Hytron go well together.

SPECIALISTS IN RADIO RECEIVING TUBES SINCE 1921

HYTRON

MAIN OFFICE: SALEM, MASSACHUSETTS

For the RECORD

BY THE EDITOR

ARE YOU READY FOR TELEVISION?

ALMOST daily the mails bring reports of new television stations coming on the air for the first time with their test patterns preparatory to the start of their regular programming schedules. In the majority of cases these stations are located in areas that have not enjoyed television before.

Many more stations are scheduled for operation in the near future and many of our readers have asked when they will get television in their city or town. It is almost certain now that the installation and servicing of the majority of video receivers in present and future areas will be done by local servicemen, either on a contract basis with the manufacturer, or as independents.

Only servicemen with proper technical and mechanical training can hope to benefit by this new market for their services. If you are not presently qualified there are several ways to prepare yourself for this new opportunity that is television, either by home study or at one of the many excellent television schools, or both.

According to *Television Digest*, the following new stations were scheduled to be on the air by the end of October. Most, if not all of them, will probably be operating by the time you receive your copy of this issue.

WJZ-TV New York; WUTV Indianapolis; WSB-TV Atlanta; WENR-TV Chicago; KOB-TV Albuquerque; WAAM Baltimore. WOIC Washington; WNBQ Chicago; WXYZ-TV Detroit; WMCT Memphis; WTTV Bloomington, Ind.; WAVE-TV Louisville; WAGA-TV Atlanta; WBAP-TV Fort Worth; KNBH and KLAC-TV Los Angeles; WTVO Detroit; WDTV Pittsburgh; WNBK Cleveland; WTCN-TV Minneapolis; and KTTV Los Angeles.

November will see these stations on the air; WDSU-TV New Orleans; KECA-TV Los Angeles; KPIX San Francisco; and KFMB-TV San Diego.

December brings WXEL Cleveland; KGO-TV and KRON-TV San Francisco; WDEL-TV Wilmington, Del.; WGAL-TV Lancaster, Pa.; and WLWD Dayton, Ohio.

For January 1949 operation; WOR-TV New York; WHTM Rochester, N. Y.; WKRC-TV and WCPO-TV Cincinnati; WHIO-TV Dayton, Ohio; WLWC Columbus, Ohio; and WOW-TV Omaha.

In February, WSEE St. Petersburg, Fla.; and WKY-TV Oklahoma City.

For March, WFBM-TV Indianapolis; WOC-TV Davenport; and WBRC-TV in Birmingham, Ala., are scheduled.

WJAR-TV Providence, R. I.; WHAS-TV Louisville; KRLD-TV Dallas; and WMBR-TV are scheduled for Spring and early Summer of 1949.

Fall of 1949 will bring WSYR-TV Syracuse, New York; WJAC-TV Johnston, Pa.; WCON-TV Atlanta, Georgia; and WAFM-TV Birmingham, Alabama.

Other stations for 1949 operation, with operating dates still undetermined are: WAGE-TV Syracuse, N. Y.; WNBF-TV Binghamton, N. Y.; WBNT Columbus, Ohio; WBT-TV Charlotte, N. C.; WFMY-TV Greensboro, N. C.; WHBF-TV Rock Island, Ill.; WDAF-TV Kansas City; WOAI-TV San Antonio; WOI-TV Ames, Iowa; and KEYT Omaha.

In addition to those stations listed, there are many more who will probably be in operation during 1949. A great many of the stations holding construction permits have already received delivery of their equipment, and are looking forward to early operation as soon as construction is completed.

Each area with a television station now in operation or in prospect, presents a new market for the wide-awake serviceman. All the receivers will require some measure of service as well as an original installation.

As additional stations come on the air in each area, the antenna systems of the receivers will probably require some re-adjustment for optimum performance on the new channels.

The appearance of additional stations serves to stimulate interest greatly, as the quality of the program material generally improves with competition.

By the end of 1949 there will be no major metropolitan area, without some measure of television service. The new combination coaxial and microwave link between Chicago and New York, including towns along the route will do much to improve the quality of the program material presented, and in turn increase the public's interest in television. Within the next two years, this system will extend across the country, affording coast-to-coast telecasts.

The future of television is assured, but only the *qualified* serviceman will be able to cash in on Video's opportunities. .....O.R.

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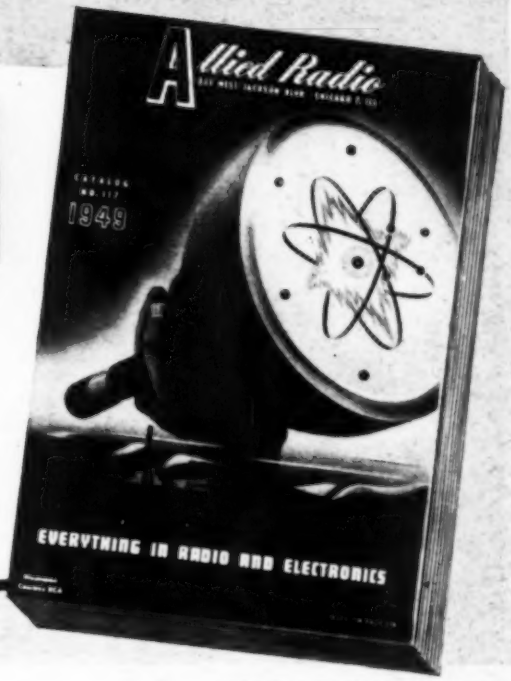

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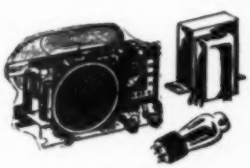

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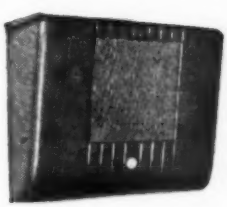

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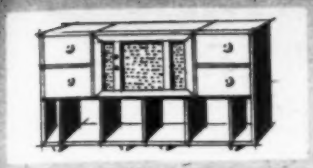

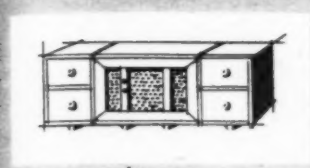

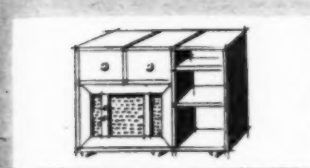

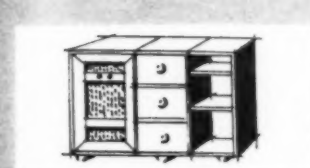

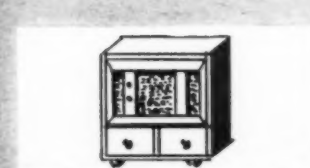

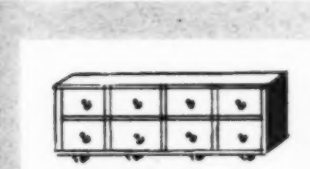

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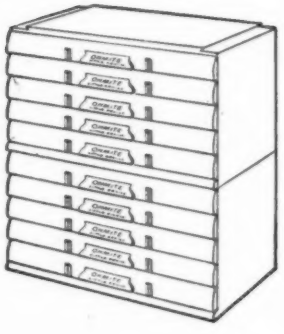
Servicemen's Assortment Contains 125 Selected ½-Watt Little Devil Composition Resistors in 40 Separate Compartments

Here's a handsome, sturdy, all-plastic resistor cabinet you'll be proud to have in your shop—and one that will save you hours of valuable time. The new cabinet is molded of solid plastic and has five drawers with eight compartments in each drawer. It is extremely compact—only 9" long, 4-¾" high, and 5-¼" deep. Factory-packed in the cabinet is a serviceman's assortment of 125 carefully selected Ohmite "Little Devil," ½-watt, individually marked, insulated composition resistors, in the 40 values (10 ohms to 10 megohms) most frequently used by servicemen. The assortment is offered at the price of the resistors alone—the cabinet is furnished without extra cost!

You'll need one or several of these handy cabinets in your shop to protect your resistors and to help you find resistance values quickly. What's more, they provide visual stock control so you can avoid duplicate inventories or unnecessary trips to your distributor. Order your assortment and cabinet from your jobber, today!

QUANTITIES AND RESISTANCE VALUES IN THE SERVICEMAN'S ASSORTMENT

Quantity	OHMS	Quantity	OHMS	Quantity	OHMS	Quantity	OHMS
1	10	3	1000	1	33000	10	0.47 meg.
1	15	1	1500	5	39000	1	0.68 meg.
1	27	1	2200	10	47000	10	1.0 meg.
1	47	3	2700	1	68000	1	1.5 meg.
1	100	5	4700	1	82000	1	2.2 meg.
1	150	1	6800	10	0.1 meg.	1	2.7 meg.
1	270	10	10000	5	0.15 meg.	1	3.9 meg.
1	330	3	15000	1	0.22 meg.	1	4.7 meg.
1	470	5	22000	10	0.27 meg.	1	6.8 meg.
1	680	10	27000	1	0.33 meg.	1	10 meg.



CAN BE STACKED ON EACH OTHER

A dovetail joint is provided on top and bottom of each cabinet so they can be stacked one on top of another.

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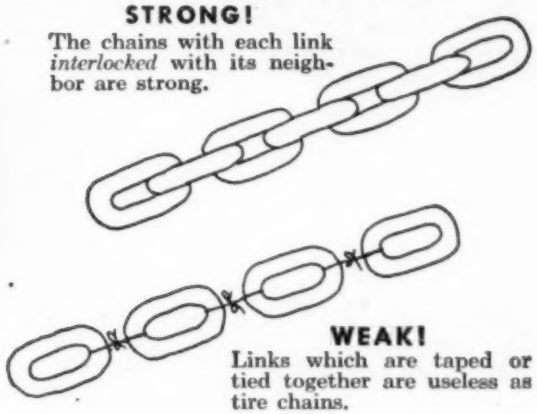
INTERLOCKED Means Strength!

STRONG!
The chains with each link *interlocked* with its neighbor are strong.



WEAK!
Links which are taped or tied together are useless as tire chains.

***INTERLOCKED*... means strength**...That's why it is important to know that *only* the New OLIN radio "B" batteries have INTERLOCKED flat cells. Other brands of radio flat cell "B" batteries are bound or linked together with paper tapes or other type wrappings.

Exclusive Patented U. S. Pat. No. 2416576

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There's Nothing Like Them . . . They're the ONLY Radio "B" Batteries in Which Each Cell Interlocks with Its Neighbor

THEY ARE BETTER IN 6 DISTINCT WAYS

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   . . . (a) insuring against power leakage
   . . . (b) gives each battery dimensional stability not found in other brands—this feature is vital.
2. Each Cell Holds More Power-Producing Chemicals.
3. No Waste Space.
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Spot Radio News

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By RADIO & TELEVISION NEWS' WASHINGTON EDITOR

WASHINGTON WILL BE quite a TV news center this fall and winter. With the FCC hearings on the effects of tropospheric interference on present and proposed allocations, high-band TV and general interference problems, reams of vital information and decisions affecting the future of television will be on the wires from Washington.

The most spectacular hearings, those on high-band TV, will reveal what industry has done and can do at the higher frequencies and thus provide a pattern of planning for many years to come. Typical puzzling problems which industry specialists will analyze include the areas of service which might be expected in the 474-, 600-, and 890-megacycle bands with equipment having bandwidths of 6, 13, or 20 mc. Radiated power possibilities, co-channel and adjacent-channel separations, and the number of channels which would be available in the 140 metropolitan districts, are other major topics which will be probed by the experts.

At this writing, representatives of all of the leading telecasters, broadcasters, component, receiver and transmitter manufacturers, were scheduled to appear at the Washington sessions: *Philco Corporation, Philco Television Broadcasting Corporation,* Television Broadcasters Association, *Allen B. DuMont Laboratories, CBS, NBC, Westinghouse Electric Corporation, Cowles Broadcasting Company, Eitel-McCullough, Inc., Television California, Inc., Twentieth Century-Fox Film Corporation, G. A. Richards* stations (WJR, Detroit, WGAR, Cleveland and KMPC, Hollywood).

Westinghouse has prepared an extensive report on its "Stratovision" program for the hearings. In a previous session, a 475-page review of the test results of the system operating on 1107.5 and 514 megacycles was offered. The report revealed that the airborne telecasts provided reception at points several hundred miles away from the station. As a result of these performances *Westinghouse* filed an application for channel 8 to operate about a point 30 miles west of Pittsburgh and provide a service in an area with a radius of approximately 200 miles.

According to the petition, the "Stratovision" station would provide service to 8,253,000 people in the 58,200 square miles encompassed by the station's 5000 microvolt contour line. (FCC regulations protect ground television channels from interference by other stations, protection extending to a rough circle around the station known as its 5000 microvolt contour line.)

The "Stratovision" plane would pick up signals from KDKA to provide the new service, the application disclosed.

The tropospheric interference probe, the subject of another FCC session, will also provide significant data and indicate whether present power and antenna height restrictions should be changed and whether protected contours should be revised.

During allocation sessions in the summer, T. T. Goldsmith, Jr., director of research of *Allen B. DuMont Laboratories,* revealed that the troposphere and distance in television reception were extremely relevant factors. Tests disclosed that waves may be trapped between two boundaries of a dense layer of air which occurs a short distance above the earth's surface, producing in effect a parallel plane waveguide, and the energy, instead of being uniformly radiated in all directions, is confined and guided along close to the surface of the earth. This condition may result in the signal strength at a distant point being many times greater than that predicted by the ground wave theory alone. These effects occur more or less at random and cannot be relied upon for any dependable service, but they create a serious interference problem. Accordingly, said Dr. Goldsmith, stations will have to be separated considerably further than would be indicated by a consideration of ground wave theory alone.

In calling the interference hearing, FCC admitted that the present standards do not include specific data on tropospheric propagation, and that the results described by industry experts confirm the studies made by the Commission's Bureau of Engineering. So, it appears as if an interesting and vital decision on the troposphere and television interference will be on the books very soon!

TV RECEIVER PRODUCTION continues to climb, with over 334,000 sets having been made since January.

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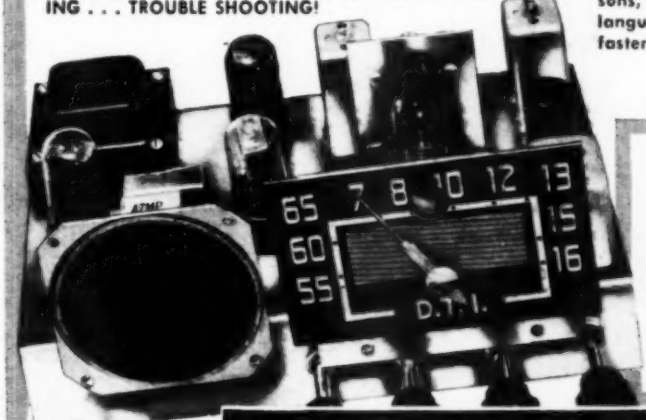

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Monthly production has been doubled since the first of the year, 30,001 sight and sound models having come off the line then, while over 64,000 units were made in June. And according to industry and trade association expert predictions, the winter months will probably see a doubling of June production.

ARCHITECTURAL REGULATIONS have now been extended to the television antenna scene. In San Diego, California, the City Planning Commisssion ruled recently that the heights of residential television antenna masts in the city's 29 architectural control districts will be limited to 50 feet above ground level. Five types of masts were approved for these zones. The only exception to the 50-foot rule was allowed to hotels, apartment houses and business buildings, where a 12-foot mast could be erected atop the roofs.

PICTURE TUBE RECORDING TRANSCRIPTION service will be used by most of the television stations in the Midwest during the coming months. With these packaged films, which will be flown to the telecasters, it will be possible to air the important large production shows put on in the East or Pacific Coast, shortly after the live presentations.

Four stations in Chicago which expect to use the picture transcriptions are WENR-TV (ABC), WNBQ (NBC), WBKB (independent which will carry CBS and perhaps *DuMont* programs) and WGN-TV (independent which will carry *DuMont* programs).

The transcription service will be found particularly handy until complete coax and microwave facilities are available. And even with the link facilities in full swing, schedule problems will make it necessary to use the films for delayed type telecasts, just as broadcasters use disc and tape recordings for delayed broadcasts.

As a result of the accelerated interest in this new mode of transcription, film and television specialists are burning the midnight oil developing improvements in equipment and materials which will bring more and more fidelity to the transcribed images.

THE FCC RECORDS reveal that many television networks are being planned, particularly in the Far West areas. In Texas, for instance, a Texas Telenet System, with stations in Austin, San Antonio, and Corpus Christi, is now on the drawing board. Microwave links, 30 to 40 miles away, are scheduled to be used to tie in the cities, which may eventually also include Waco, Fort Worth, Dallas, Houston, Wichita Falls, etc.

IT'S BLACK AND WHITE TV for the British, too. A decision by the television committee of the British Broadcasting Corporation states that

(*Continued on page* 144)

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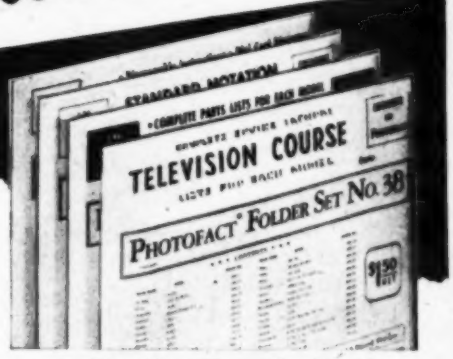

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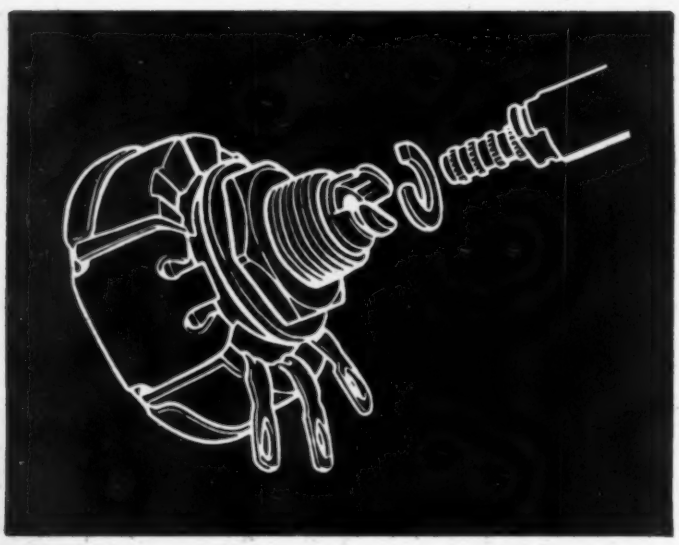

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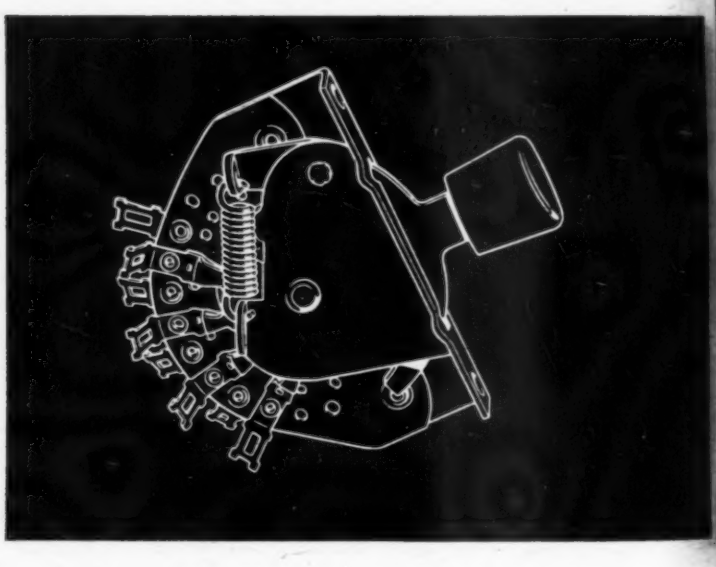

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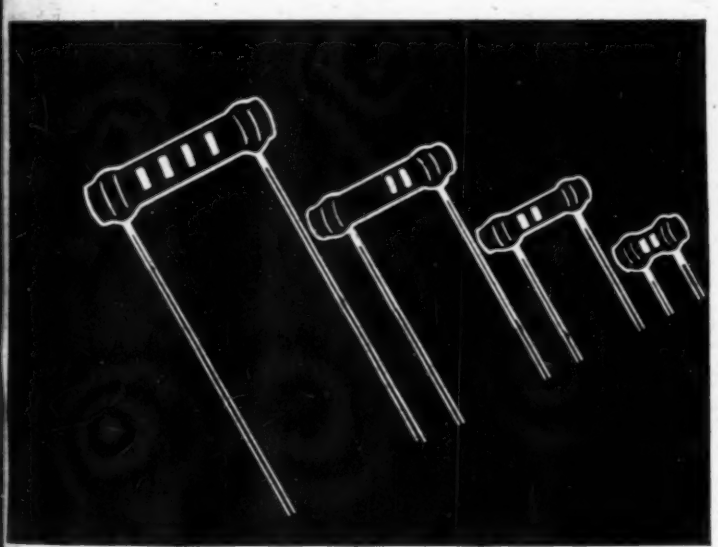

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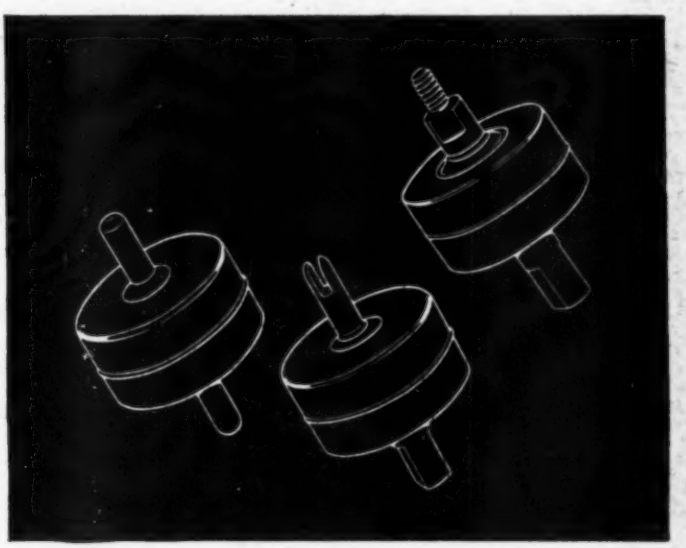

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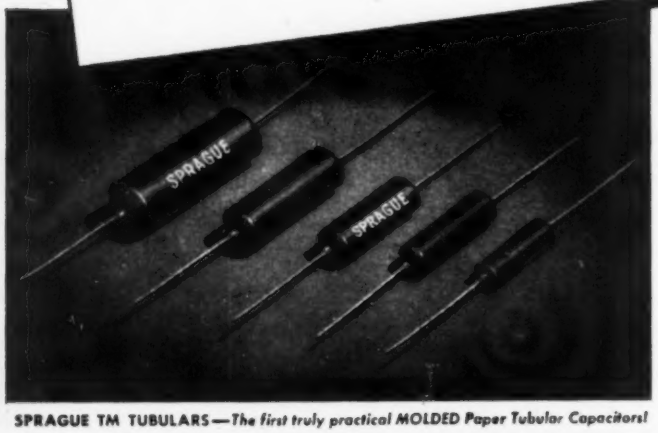

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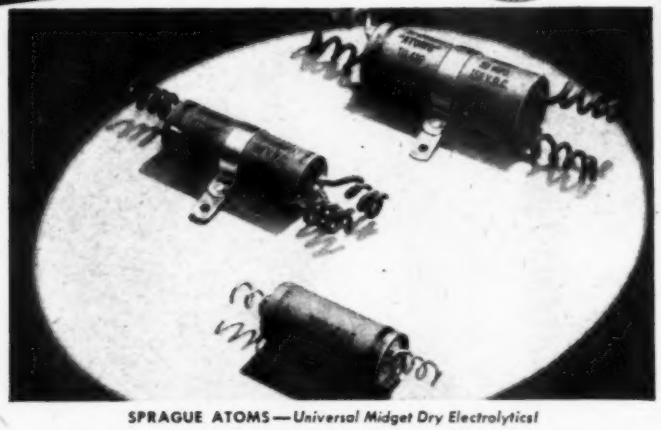

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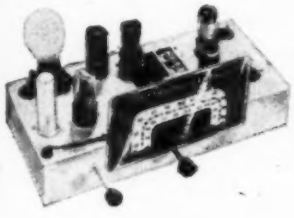

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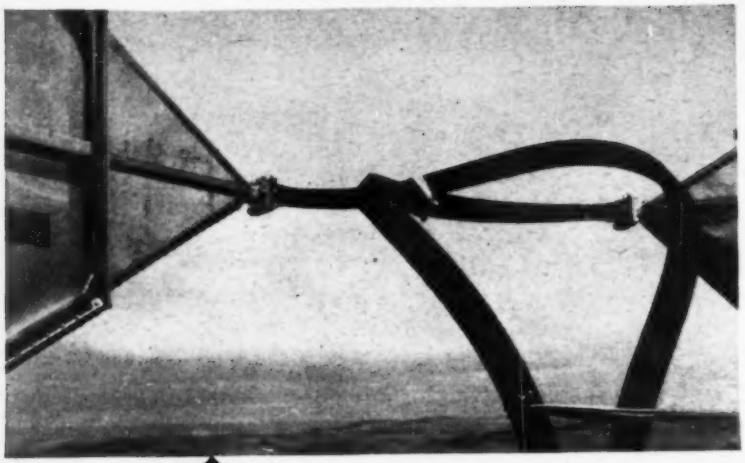
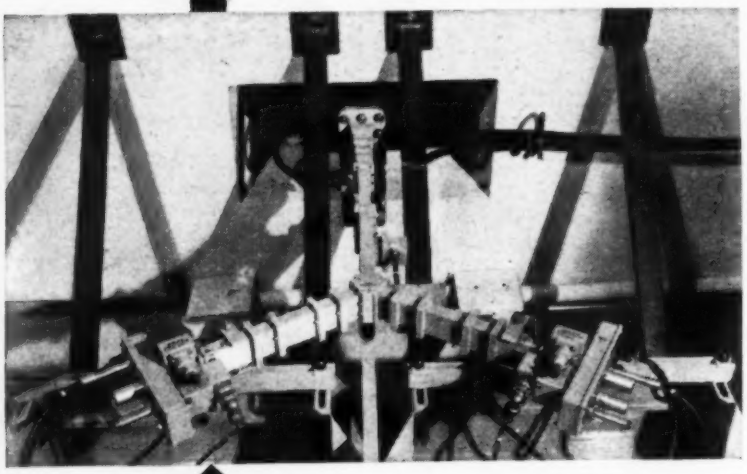
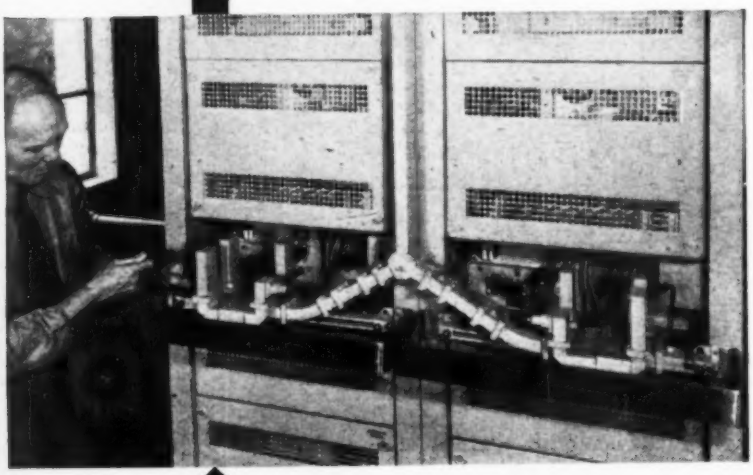


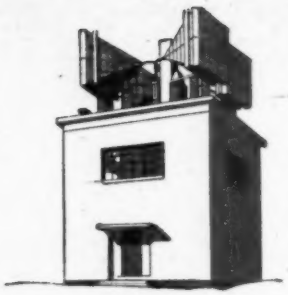
3 The waveguide connects with antennas, which are oriented in azimuth with antennas at next station. At right is complete repeater station.



2 The waveguide continues upward through the roof of the station toward the antennas.



1 Base of a waveguide circuit in a repeater station of the New York-Boston radio relay system.



Pipe Circuits

UNLIKE radio broadcast waves, microwaves are too short to be handled effectively in wire circuits. So, for carrying microwaves to and from antennas, Bell Laboratories scientists have developed circuits in "pipes," or waveguides.

Although the waves travel in the space within the waveguides, still they are influenced by those characteristics which are common to wire circuits, such as capacitance and inductance. A screw through the guide wall acts like a capacitor; a rod across the inside, like an inductance coil. Thus transformers, wave filters, resonant circuits – all have their counterpart in waveguide fittings. Such fittings, together with the connection sections of waveguide, constitute a waveguide circuit.

From Bell Laboratories research came the waveguide circuits which carry radio waves between apparatus and antennas of the New York-Boston radio relay system. As in long distance wire communication, the aim is to transmit wide frequency bands with high efficiency – band widths which some day can be expanded to carry thousands of telephone conversations and many television pictures.

Practical aspects of waveguides were demonstrated by Bell Telephone Laboratories back in 1932. Steady exploration in new fields, years ahead of commercial use, continues to keep your telephone system the most advanced in the world.

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Within the INDUSTRY

ALLEN B. DUMONT LABORATORIES, INC. has moved the Television Receiver Sales Division of the company to new and enlarged quarters at *DuMont's* 515 Madison Avenue, New York headquarters.

The division which was formerly located in a section of the second floor now occupies the entire 41st story of the building.

Until quarters have been completed, the receiver showroom and offices of service technicians will remain at their second floor locations.

* * *

JAY C. FONDA, nationally known sound recording engineer, has joined the *Morris F. Taylor Company,* manufacturers' representatives of Silver Spring, Maryland.

Mr. Fonda has relinquished his private engineering consultant practice to join the *Taylor* organization where he will serve as sales engineer calling on industrial plants in eastern Pennsylvania, Delaware, and southern New Jersey.

Mr. Fonda formerly headed *Fonda Sound Corporation,* was vice-president and director of engineering of *Fonda Corporation* and president and chief engineer of *Jay C. Fonda, Incorporated.* He has also held the position of chief engineer with *Jefferson-Travis Radio Company.*

* * *

LUND-HANSEN COMPANY has been recently organized in Chicago to represent the electronic parts manufacturers who prior to the formation of the new company were represented by *Ralph T. Brengle Sales Company.*

The *Brengle* organization will devote full time to national sales for *Potter & Brumfield Mfg. Co.* and *Montgomery Mfg. Co.* The new organization will handle the lines of *Precision Apparatus, University Loudspeakers, Marion Electrical Instrument, Premax Products, Special Products Co.* in addition to representing *Potter & Brumfield* and *Montgomery* locally.

Principals in the new firm are Russell Lund and Dudley Hansen, both of whom have been handling sales for the *Brengle* organization for the past several years. Mr. Lund held positions with *Raytheon, Clough-Brengle,* and *Thordarson* before joining *Brengle.* Mr. Hansen was in the Engineering Department of *Admiral Corporation* and was, prior to that time, associated with *Grigsby-Grunow.*

Lund-Hansen Company is sharing offices with *Ralph T. Brengle Sales Company* at 549 West Washington Boulevard, Chicago.

* * *

BERT COLE, vice-president and general manager of *Crosley Distributing Corporation,* has been elected to the board of directors of the corporation.

The announcement followed a recent disclosure by Mr. Cole that the 1948 sales volume of the New York outlet for the *Crosley Division, Avco Manufacturing Corporation* was the highest in its history and more than double the volume attained during a similar period last year.

The *Crosley Distributing Corporation* handles *Crosley* radio and television receivers and the company's line of home appliances. Executive offices and display rooms are located at 1775 Broadway in New York.

* * *

BENDIX RADIO has announced the appointment of four district merchandisers to complete its radio and television sales organization.

W. J. Lancaster, who maintains offices at 16 Beale Street, San Francisco, will cover the entire Northern California territory.

James V. Cunningham, operating as the *Telerad Sales Co.,* 30 Huntington Avenue, Boston, is the new district merchandiser for Eastern Massachusetts and Rhode Island.

Western Massachusetts will be covered by Louis Del Padre, 1162 River Road, Agawam, Massachusetts.

The second western appointment named Roy P. Mulhausen, operating as the *Nelfram Co.,* 702 Ernest and Cramer Building, Denver, to cover that territory for *Bendix.*

* * *

E. H. FRITSCHEL has been named manager of sales for the Industrial and Transmitting Tube Division of the *General Electric* Tube Division at Schenectady.

Mr. Fritschel graduated from Iowa State in 1926 with a B.S. degree in electrical engineering and immediately joined *General Electric Company* as a student engineer on the test course. In April 1927, he went to Uruguay as a construction foreman for the installation of radio transmitting equipment, later doing development work at Schenectady.

In March 1929 he was transferred to the Radio (now Electronics) Department where he has handled radio transmitter and industrial electronic

A Sensational Announcement to the "Top Third" of the Servicing Field!

Now, after two years of preparation, CREI introduces its new home study course in

TELEVISION AND FM SERVICING

G.E. PHOTO

100% Practical "On-the-Job" Course That Equips You to Install and Service ALL Types of Television and FM Receivers

This is the big changeover year—from radio to television.

It is the year for you and all servicemen to make the big decision. Either you are going to catch up with the new developments in the industry, or you are going to be passed by. There are new techniques—entirely new methods of technical "know how" to be learned and mastered, if you are going to be in a position to handle good-paying Television and FM business.

This new course was prepared by CREI at the request of several large manufacturers, distributors and dealers who said, "We must have more servicemen trained to handle the approximately 800,000 television sets and 4,000,000 FM sets to be produced this year alone!" CREI knows exactly what you need and every effort has been made to keep this course practical and to the point. If you are now in service work you will be able to thoroughly understand and apply each lesson. It has been reviewed and checked by qualified service experts who know what *you must know* to get ahead in this booming field.

CREI has never attempted "high pressure" selling of any kind. In introducing this course, we believe honestly that it can provide you with the ability you must have to hold your job—qualify for a better one—or start your own business.

To such familiar service terms as "tone, selectivity, circuit noise, AVC, feedback, etc.", must be added such terms as, "dipole, rasters, clippers, clamping circuits, synch pulses, blanking pedestals, etc." Do you understand this new language? Are you qualified to install and service all types of Television and FM Receivers?

TV and FM will make more progress in the next 10 months than they have in the past 10 years. Just think of the extraordinary opportunities this opens up for you. Here in one practical course at a popular price, CREI offers you security and more money.

Don't put it off. Get going now and get in on the big money that is going to be made by those men who have equipped themselves to handle the "sets of tomorrow."

Start your training now and you start applying your new-found knowledge immediately. Every lesson in this course can be helpful in your daily work. As you progress in your training you will find yourself equipped to handle complicated Television and FM work that only a few months ago looked "impossible". The time to start is now.

It costs you nothing but a few minutes time to read the interesting facts and the complete lesson-by-lesson outline. So practical, so simple to understand. Mail the coupon now for complete information.

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tube sales. Prior to his new appointment he was manager of sales for the Tube Division.

* * *

GENERAL TELEVISION CORPORATION has changed its corporate name to *Starrett Television Manufacturing Corporation*. The change has been made to avoid an inadvertent conflict with the name of an Illinois corporation which is no longer in business.

The company will continue to manufacture its complete line of television receiving sets at its factory, 601 West 26th Street, New York.

The company also announced the opening of a showroom for the display of its receiving sets to dealers at 521 Fifth Avenue, New York.

* * *

WILLIAM F. ANDERSON has recently been named director of sales for *Super Electric Products Corporation* of Jersey City, manufacturers of a line of r.f. and i.f. power transformers and radio and television components.

Mr. Anderson was formerly co-owner of *Utility Sales Associates* of New York City, manufacturers' representatives and brokers in electrical and steel products.

During the war he was district manager of the New York Production Field Office of the Signal Corps and for twenty years before the war was associated with the *Frigidaire Division* of *General Motors Corporation*.

* * *

G. V. BUREAU has joined the Power Tube Division of *Amperex Electronic Corporation* of Brooklyn, New York.

Mr. Bureau was formerly associated with the Cathode-Ray Tube Division of *North American Philips Company, Inc.* of New York and had previously been connected with *National Union Radio Corporation* and other electronic firms.

* * *

KURT EMDE, chief mechanical engineer of the Household Radio Division of *Zenith Radio Corporation,* died recently at the company's plant in Chicago.

Mr. Emde was born in Germany and received his education in schools and colleges in that country. He joined *Zenith* in 1934 as a mechanical designer, and was named chief mechanical engineer of the company a short time later. He was a member of the Chicago Technical Society and was widely recognized throughout the radio industry for numerous mechanical engineering and design developments and improvements.

* * *

ADMIRAL CORPORATION has announced the formation of an International Division to handle the marketing activities of *Admiral* products outside the continental United States and Canada.

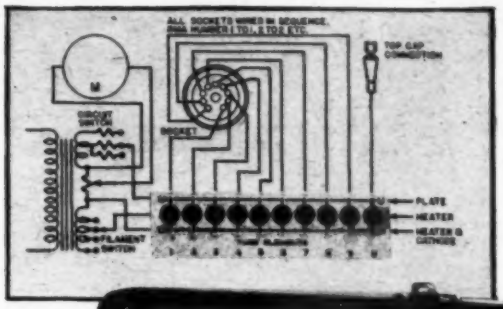
Heading the new division is George

(*Continued on page* 132)

Tube Testers for Today and Tomorrow... SPECIFY TRIPLETT

UP and DOWN

Lever Switching Connects Each Tube Pin to Proper Circuit



1. **ALL ELEMENT CHECK** — Thorough conclusive test of tube elements, shields and taps. The only commercial tester to get at each tube pin and make an open and short check.
2. **NO HUNTING FOR SOCKETS** —No plugging into wrong socket. Circuit flexibility requires only one socket for each type of tube base.
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5. **"PICTURE" YOUR CIRCUIT** —Assures confidence in tests and enables special tube checks for balanced circuits, special loads, etc. "Trick" switching circuits make it more difficult for the serviceman to "picture" his test circuit.
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7. **INDIVIDUAL CONTROL FOR EACH TUBE ELEMENT** — Takes care of roaming elements, dual cathode structures, multi-purpose tubes, etc., in addition to standard value tests.

TUBE TESTER MODEL 3413
Triplett lever switching circuit arrangement has 7 distinct advantages contributing to maximum flexibility, simplicity of operation and anti-obsolesence.

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. . . Combination
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This tester combines the Tube Tester Model 3413 with complete facilities for voltage current and resistance analyses . . . a real economy for those shops requiring a combination tube tester and volt-ohm-mil-ammeter . . . Attractive two tone metal case with detachable hinged cover . . .

TECH DATA

D. C. Volts: 0-3-12-60-300-1200, at 10,000 Ohms/Volt.
A. C. Volts: 0-3-12-60-300-1200, at 2,000 Ohms/Volt.
D. C. Amps: 0-12, at 250 Millivolts.
D. C. Milliamps: 0-1.2-12-120, at 250 Millivolts.
Ohms: 0-1000-10,000 (10-100 at center scale).
Megohms: 0-1-50 (10,000-500,000 Ohms center scale).
Output: Output Jacks, Condenser in series with A. C. Volt ranges.
Scale: 5.6" long on top scale arc. 0-1000 Ohms and 0-50 Megohms on top arc. 0-12-60-300 A. C. and D. C. Volt figures are on four separate arcs. Scale markings are black on white except A. C. are red on white; O-1K Ohms scale is green on white.

MODEL 3480 **$98.75** . . . U.S.A. Dealer Net

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Chicago Transformer's *New Equipment Line* fills an urgent need in the electronics fields for transformers designed exclusively to fit up-to-date circuit requirements. Here's why . . .

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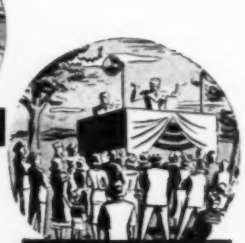
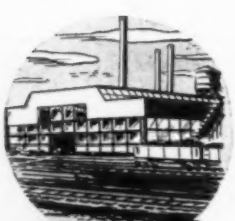

PUBLIC ADDRESS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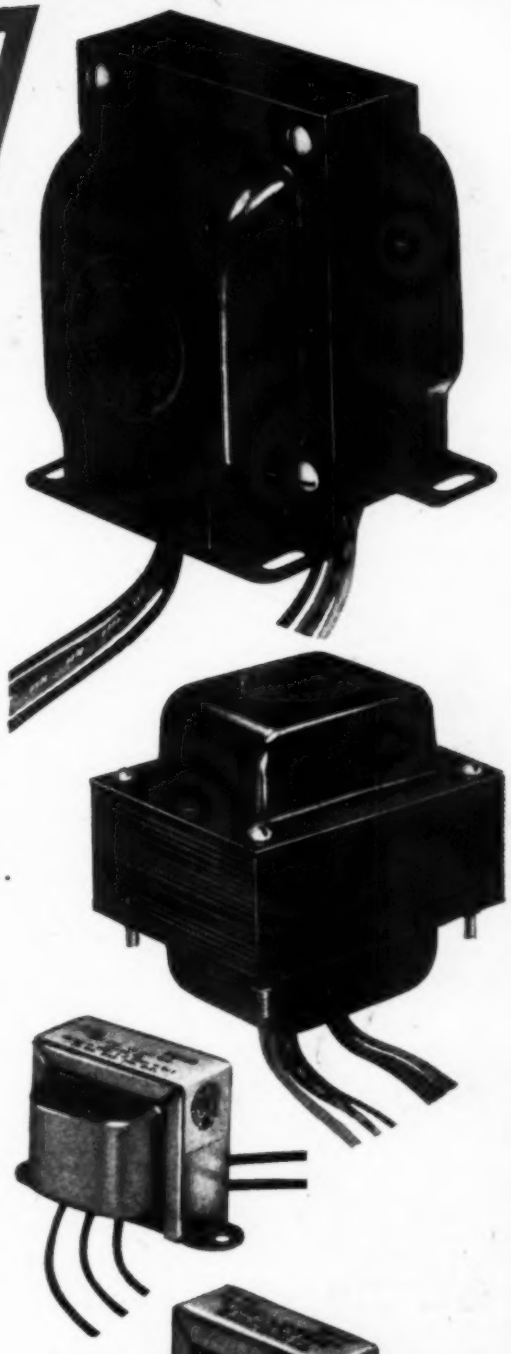

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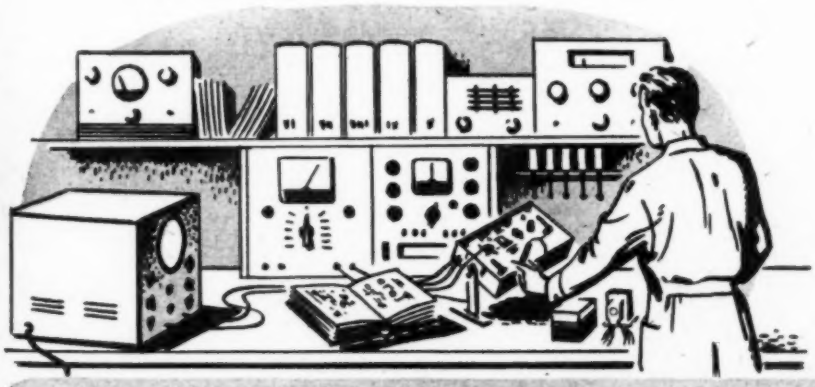
Ask for *Chicago* Replacement *Transformers* the next time you call or visit our parts jobber. *In the meantime . . .*

WRITE FOR CATALOG



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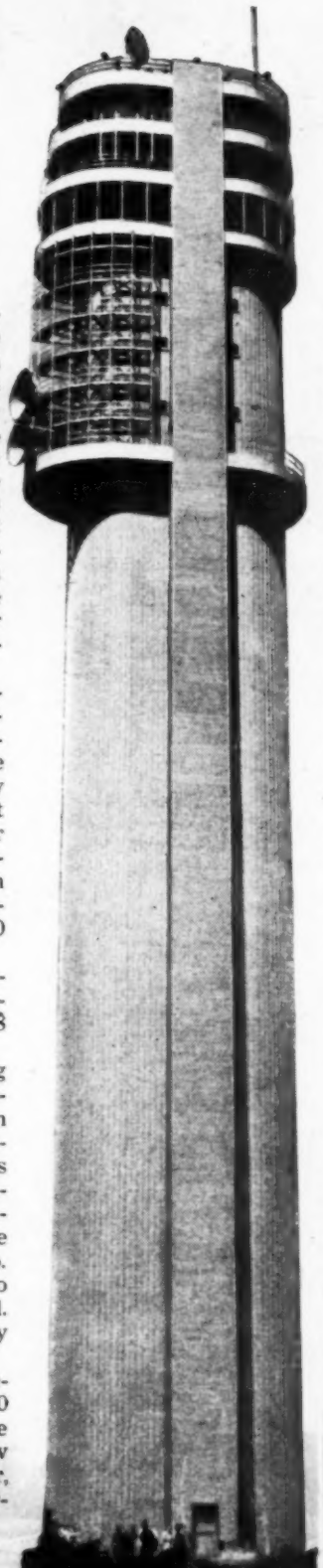
MICROWAVES for Relaying TV Programs

By
SAMUEL FREEDMAN
DeMornay Budd Inc.

An up-to-date survey of the projected and existing relay facilities for network transmission of television.



THE writer has just completed a comprehensive survey of the microwave relay field as used for the transmission of television between various cities. It has been undertaken with the excellent cooperation of *Bell Telephone Laboratories, American Telephone and Telegraph Company, DeMornay Budd Incorporated, National Broadcasting Company, Columbia Broadcasting System, Allen B. DuMont Laboratories, Inc., General Electric Company,* and the *Western Union Telegraph Company.* All of these organizations are currently making use of microwaves for television relaying with or without connecting coaxial cables.

While the use of microwaves for television relaying is still in its infancy, it already is serving over a tenth of our population area. Its utilization to date despite the experimental nature and relatiyely early design of equipment, leaves no doubt in the mind of any television broadcaster as to its practicability and increasing utilization. Systems are already in operation in various parts of the ultra- and super-high-frequency spectrums between 900 and 7000 megacycles.

The principal systems which have actually been operating during the unprecedented growth of television during 1948 are:

A. The *Bell* system operated by the Long Lines Department of the *American Telephone and Telegraph Company* between New York and Boston with seven intermediate repeater-booster stations. It ties in at New York with coaxial cable to Washington, D.C. It has been sufficiently promising to justify immediate expansion of the system to Chicago as the next major step. For this purpose, 31 intermediate radio repeater-booster stations will be required. It will be completed in late 1949 or early 1950.

B. The *Philco* microwave relay system between New York and Philadelphia on 1370 and 1410 megacycles operated as part of the *NBC* television relay system between New York and Washington. Beyond Wyndmoor, Pa. it becomes the *RCA/NBC* system operating on approximately 7000 megacycles.

C. The *General Electric* system on approximately 2000 megacycles extending from New York City to Schenectady, N.Y. in one direction only.

D. The *Western Union Telegraph Company* microwave relay system now closing in the New York-Washington-Pittsburgh triangle and slated to next continue towards Chicago in its eventual nation-wide coverage.

E. The *Raytheon* system from Boston to New York undertaken experimentally and currently closed down pending further plans.

Fig. 2 shows the *Bell System's* coaxial cable and radio relay program as it exists at this time and as it is expected to become by 1950. While microwaves were retarded in civilian development by the high classification it held for purposes of national defense and the quest for suitable tubes to generate the necessary frequencies, coaxial cables had an opportunity to gain a foothold. At the present time, coaxial cables are being used to relay television programs wherever they are available. The *American Telephone and Telegraph Company* has set up a rate schedule which makes no distinction between microwave relays and coaxial cables. In fact, both may be used in the same system to bring the program to the distant radio receiver. The basic rate for leasing a single television or "video" channel is now $35 per month per airline mile for eight consecutive hours each day and $2 a month per airline mile for each additional consecutive hour. By the end of 1948, the *Bell System* expects to provide service for television program transmission so that about 40 million people will be residing in the areas which the facilities will be able to reach. Before the end of 1948, the midwestern network will be joined with the eastern network. Initially constructed in the experimental shops of the *Bell Telephone Laboratories,* the magnitude of the microwave relay program has made it necessary to now turn over the manufacture or production to the factories of the *West-*

Fig. 1. The microwave antenna tower of the Federal Telecommunications Labs at Nutley, N. J.

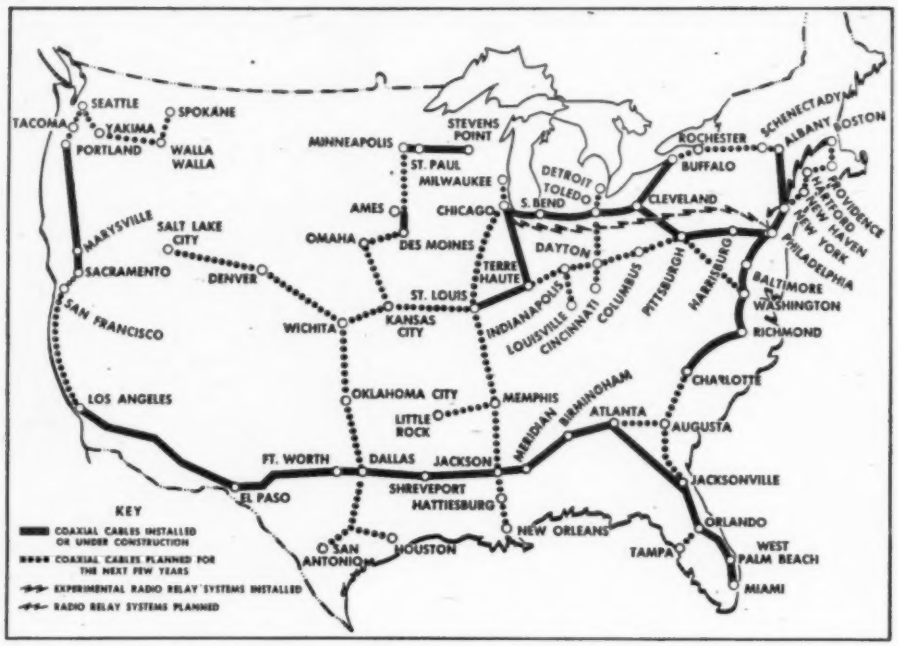


Fig. 2. The Bell System coaxial cable and radio relay routes.

ern Electric Company at Kearny, N.J. and Winston-Salem, North Carolina.

The use of coaxial cable in lieu of or in connection with a microwave relay system makes it necessary to reduce the channel-width to 2.7 megacycles. While coaxial cables are capable of handling much greater bandwidths, they can only do so by the use of more closely spaced booster stations in order to compensate for the excessive increase in attenuation with increase in bandwidth. The 2.7 megacycle channel-width represents the best compromise at present for coaxial cable transmission of television without excessive attenuation, or spacing the repeater-booster points closer than their present eight mile separations. Microwave systems, in practice, are being spaced about 30 miles apart and are not limited in bandwidth. Widths of 4½ to 6 megacycles are particularly convenient to provide. It will also not be too difficult a problem for microwaves to handle 20 megacycle bandwidth as color television goes into operation by such pioneering organizations as *Columbia Broadcasting System* and the *Radio Corporation of America*. At the present time, systems tying in with coaxial cable are engaging in narrower band television transmission than are systems which use microwave relay exclusively. The wider channel width is resulting in better transmission although the 2.7 megacycle channel is by no means unsatisfactory. The excellent engineering and design provisions have done much to offset the disadvantage of the narrower band. At the present time coaxial cable costs about a dollar a foot or about $5000 per mile material cost. One such cable comprises eight coaxial tubes, each capable of handling a program. When the right of way, cost of laying it underground, and the cost of frequent booster stations are included, the over-all cost of construction can reach a figure as high as $50,000 per mile as it runs rather than airline distance. It is not expected to equal that figure even for the most elaborate microwave installations. However, the cost of the *Bell* microwave relay system from New York to Boston may compare in cost with coaxial cable per channel because no expense was spared in the initial system. The individual buildings have cost approximately $60,000, access roads have been built at a cost of approximately $30,000 per station, duplicate spare bays have been provided for all equipment channels, elaborate emergency power facilities are included, along with alarm provisions for unattended operation and for complete utilities at each location. This cost can be greatly reduced per channel either by the use of less elaborate facilities or by having the same facilities accommodate additional channels of communication as the microwave relay program expands.

Fig. 3. Bell System's New York-Boston radio relay network.

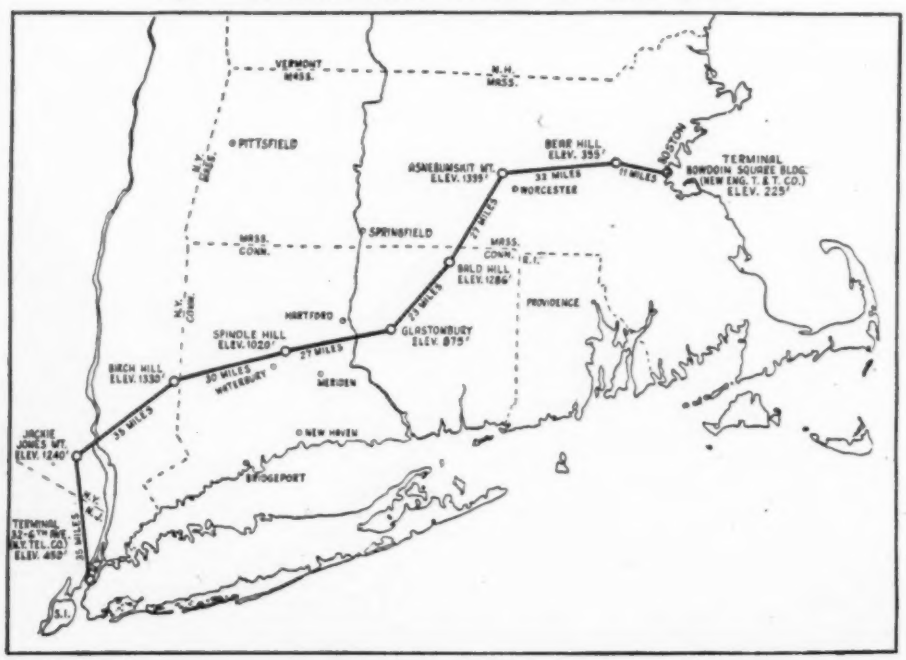


Fig. 9 shows the external and Fig. 8 the internal views of a typical radio relay station along the New York to Boston route. It is designed for unattended operation except for weekly inspection. On the ground floor are located the heating and air conditioning system, washroom, converter emergency power supply with bank of storage batteries and auxiliary emergency battery-driven generator. Behind a fireproof partition on the same floor, there is also provided a 20 kilowatt generator for emergency use. In the event outside power fails, there is quick emergency power of reduced amount followed by delayed emergency power of adequate amount. Within two seconds after outside power fails, the storage batteries automatically start a generator which can deliver power sufficient for the radio channel equipment only. In the meanwhile, the gas engine generator of 20 kilowatt capacity starts up and undergoes a warming-up period for stable operation requiring about eight minutes. At the end of that time, the larger generator takes over the load for the entire building in addition to the radio equipment. The battery generator then shuts off automatically. Emergency power of adequate amount can then be provided indefinitely subject only to the amount of fuel in the storage tank.

The equipment comprises four identical bays located on the second floor. These represent two channels actually operating (one in each direction) and two spare channels of identical type that can take over in the event any

channel fails to function properly.

At the New York terminus two bays are provided. At the relay stations four such bays are necessary without the local monitoring and interconnection provisions to coaxial cables. The electrical load requirement is approximately two kilowatts per bay. The spare bays are also energized so that no time need be lost in changing over. Thus, the total equipment load is about 8 kilowatts at each relay station.

From the equipment, rigid waveguide transmission line extends upward to the four metal lens antenna horns mounted on what might be considered to be the equivalent of the fourth story. Special radio towers are not employed. The hilltop location itself furnishes the horizon while the rooftop is sufficiently elevated to clear trees and other local obstructions. Flexible waveguide connects from the vertical rigid waveguide to the horn antennas. The front of each horn is covered with fiberglas to prevent entry of moisture, insects, or superfluous material. Two of the horns face towards New York (one for transmission and one for reception operating 40 megacycles apart) while the other two face in the Boston direction adjacent relay station.

The possibility of any relay station responding to signals coming from more than the adjacent station alone is minimized by three provisions, namely:

1. The relay path is not a straight line from New York to Boston. It is deliberately run with some change in direction at each station as is evident from a study of Fig. 3.

2. The use of highly directive antennas having a beam width of only 1½ degrees. These provide both energy concentration and reduction in interference from undesired points.

3. Change in frequency at each repeater station either by alternating a pair of frequencies or by the use of additional frequencies as are available or required.

Fig. 4. Gasoline generator used to energize microwave field testing equipment in connection with preliminary work on the $500,000 microwave relay from Chicago to Milwaukee.

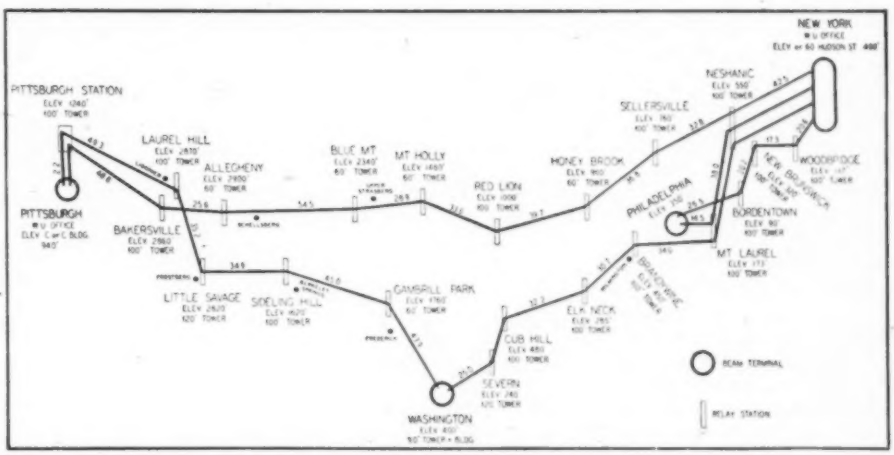


Fig. 5. Locations and tower elevations on the New York-Washington-Pittsburgh triangle.

Each relay station provides a new horizon of range as well as restoring the attenuated incoming signal to full power before being retransmitted. The

Fig. 6. Experimental microwave TV transmitter and antenna system at Hollywood for relaying signals to Mt. Wilson station.

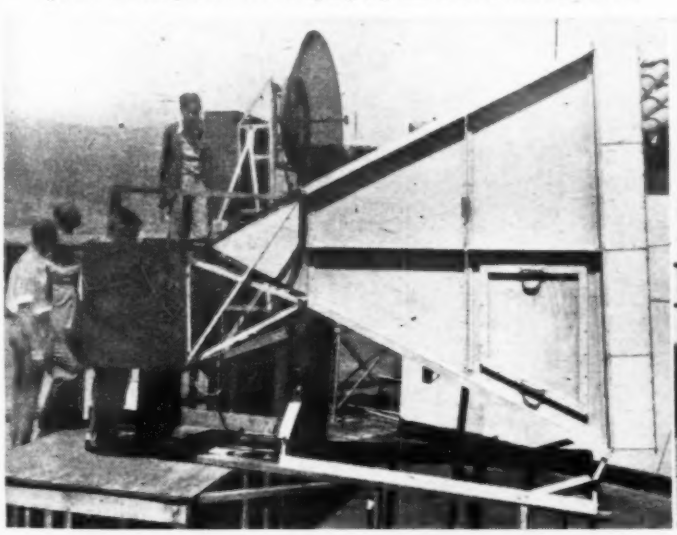
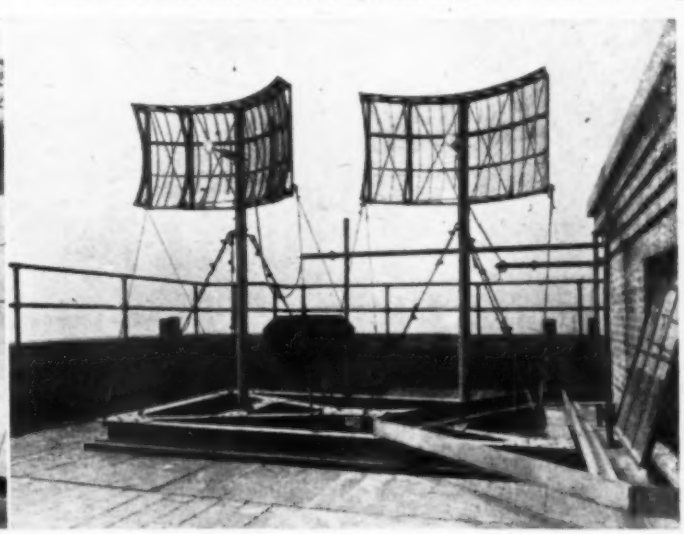


Fig. 7. Raytheon's experimental transmitting and receiving antennas and associated reflector systems at New York terminus.



power of each relay station is identical to the power of the originating point.

In order to permit unattended operation, other than routine weekly maintenance visits, a wire line runs to the Maintenance Test Center at Southfield, N.Y., 12 miles away in the case of Jackie Jones Mountain location. A step-by-step selector can transmit a large number of indications or warnings from the relay station to the maintenance center. These include:

Functions 1 to 4 to indicate that power is low on one of the corresponding channels or equipment bays.

Function 5 might indicate that the door to the building has been opened.

Functions 6 and 7 might mean that temperature is too high on the first or the second floors respectively.

Functions 8 and 9 might mean that the temperature is too low on the first or the second floors respectively.

Function 10 may indicate that the outside power has failed.

Function 11 might indicate that emergency power from the storage batteries is operating the equipment.

Function 12 might indicate that the main emergency generator has started up.

Additional functions are provided, as required, for a particular station.

An example for a particular station might be that a loss of 31 db. takes place in the transmission from or to an adjacent station. The signal may be received on 3930 megacycles, restored in signal strength and retransmitted on 3970 megacycles.

At the transmitting terminus, the sequence of events is as follows:

1. Video from a television studio is received by coaxial cable. In other systems this could alternately be by microwaves or by direct reception on a television receiver. The coaxial cable may be one ⅜" cable of several in the over-all cable. It is intended to pass 2.7 megacycles, in the case of the *Bell System*.

2. It undergoes amplification at the video frequency.

3. The signal then encounters a reactive network so that variations in amplitude give variations in reactance of an oscillator having a mean frequency of 65 megacycles which phase modulates the transmitter at that frequency.

4. This is fed to a balanced crystal modulator. An FM signal from the microwave oscillator is also injected so as to step the 65 megacycles up to the microwave frequency.

5. The signal then leaves the balanced modulator, then passes through four r.f. amplifier stages to the antenna.

At the receiving terminus or at a repeater-booster point, the sequence of events is as follows:

1. The signal picked up by the antenna system is fed through filters to the balanced crystal converter.

2. A local oscillator results in an i.f. frequency of 65 megacycles.

3. It then undergoes a 20 db. gain in a preamplifier and a 50 db. gain in the main amplifier at the i.f. frequency.

4. It then feeds through FM receiver limiter and discriminator network.

5. The output goes through a video amplifier and feeds into the local video cables or other provision.

The microwave tubes employed are the Type 2K56 reflex oscillators and four stages of Type 402A amplifiers staggered to give about a half-watt output. If any unit fails in a relay station, it is sent back to the maintenance center at Hartford, Connecticut even if it involves no more than the changing of a tube. This permits proper equipment adjustment on the basis of the replaced tube.

The frequency tolerance authorized by the FCC for this particular type and frequency is .05%. Some modification in antenna horn placement was necessary at the first repeater station because the building was inadvertently spotted on the basis of magnetic rather than true geographical bearings. As a result, a discrepancy of about 15 degrees took place. This is a danger which relay station planners should guard against in spotting a structure and the directive antennas which it must support.

The microwave radio system used by the *National Broadcasting Company* between New York City (Radio City control point for reception and Empire State building for transmission) and Washington, D.C. also serves intermediate cities such as Philadelphia and Baltimore. The system is partly owned by *Philco*, as far as Philadelphia, while *RCA/NBC* own it the rest of the way. The *Philco* portion operates on nominal frequencies of 1370 and 1410 megacycles. The remainder operates on frequencies between 6900

(*Continued on page* 150)

Fig. 8. Cut-away view of a typical radio relay station on the Bell System radio relay route between New York and Boston, showing arrangement of equipment in the building. Emergency power equipment and storage batteries are on the first floor, radio equipment on the second floor, and special microwave antennas for receiving and beaming are located on the roof.

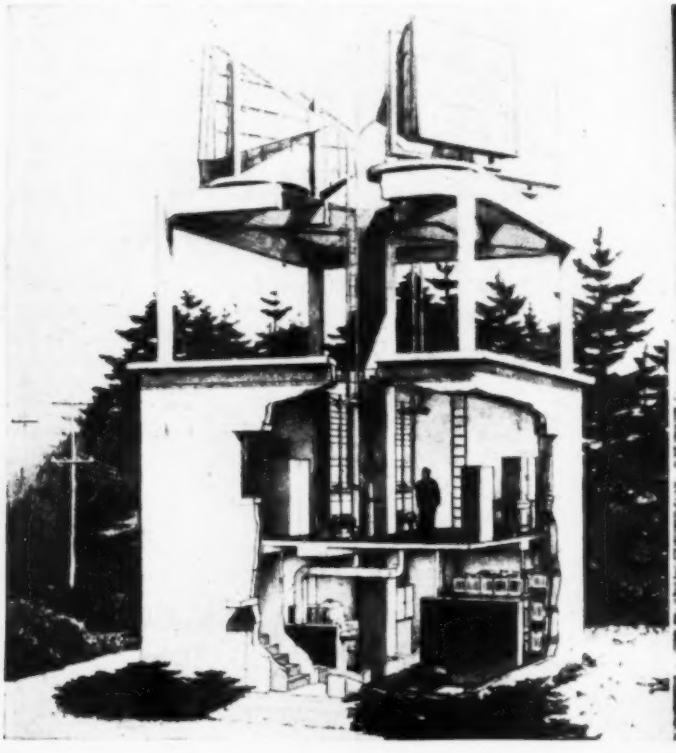


Fig. 9. One of the seven intermediate hilltop stations along route of the Bell System's new radio relay system between New York and Boston. Electro-magnetic lenses in the four horns atop the buildings receive and transmit long distance communications between the two stations. This is the station which is located on Jackie Jones Mountain near Haverstraw, New York.

Adapting Webster Record Changers for Microgroove Recordings

By
ROBERT W. TIMMERMAN, W8YIF

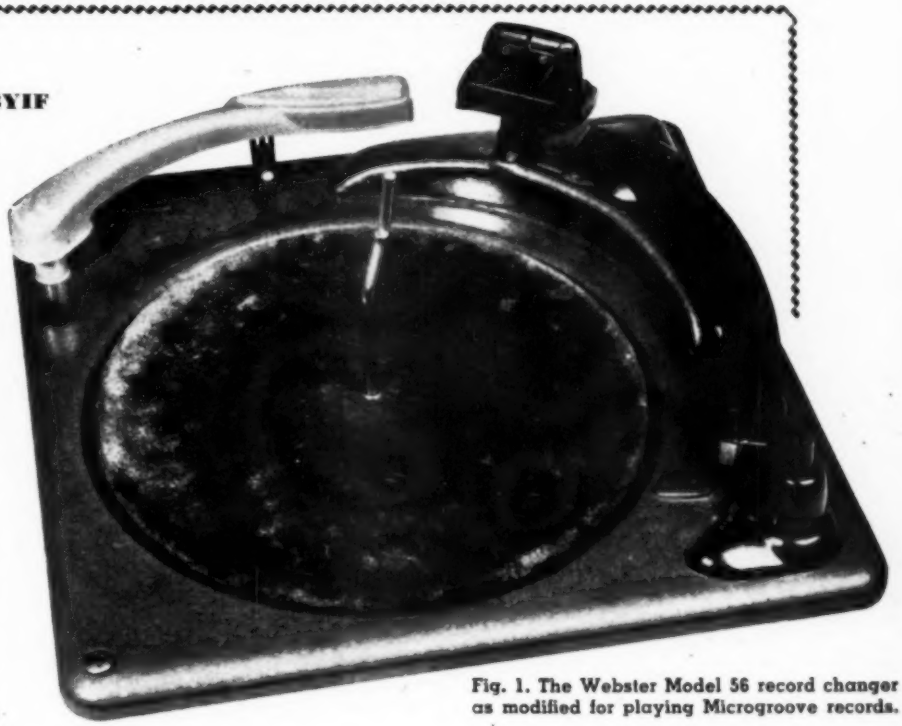


Fig. 1. The Webster Model 56 record changer as modified for playing Microgroove records.

Reproduction of Columbia's new Microgroove records requires a new pickup and a 33⅓ r.p.m. turntable.

OWNERS of *Webster-Chicago* record changers Models 50, 56, and 70 will be pleased to learn that these machines can be readily adapted to handle the new Long-Playing (LP) Microgroove records. The modification in no way hinders the playing of older type records, and a switch from one type to the other can be accomplished in about half a minute.

Two major changes in recording characteristics make possible the long-playing feature of the new records; the rotation speed has been reduced from 78 to 33⅓ r.p.m., and the grooves which have been made much narrower and closer together. Associated changes must be made in the playing equipment. The speed of the *Webster* turntable is altered by a simple change in the diameter of the drive motor pulley, and the addition of a pickup of the lightweight, Microgroove type mounted on the baseplate. The existing pickup and changing mechanism are not disturbed. Of course, the automatic changing feature cannot be employed when playing microgroove records, but these pressings are such that it is usually necessary to turn a record over for proper playing sequence, which the changer cannot do in any case.

The following discussion is a detailed description of the modification procedure. Turntables of all the *Webster* machines are driven by friction pulleys. The motor drives a rubber idler wheel, which, in turn, drives the inside of the table rim. The motor is of the shaded pole induction type, the speed of which cannot be satisfactorily changed. The change is accomplished by altering the drive ratio from motor to turntable. The motor speed is approximately 1650 r.p.m. with a step-down of about 21 times to 78 r.p.m. For a turntable speed of 33⅓ r.p.m. the ratio must be increased to 50. To do this, the diameter of the motor pulley must be reduced from 0.456 inch (in the 60-cycle model) to about 0.195 inch. The diameter of the motor shaft is ¼ inch. The problem is, therefore, to reduce the diameter to the required dimension. If a lathe is available, the shaft may be turned down in the conventional manner, however the necessary work can be done satisfactorily with a small, flat file as the only tool.

Remove the motor from the underside of the baseplate, leaving the electric connections intact. Remove the brass pulley from the shaft, rest the motor on its side on a firm support, and start it running. By gentle application of the file, gradually reduce the shaft diameter for a length of about ⅝ inch. Most of the cutting is done under the influence of the shaft rotation. Care should be taken to keep the cut flat and parallel to the shaft axis. A micrometer is helpful at this stage, but an acceptable job can be done by eye. When the diameter has reached about 0.2 (13/64) inch, proceed cautiously to avoid making the shaft too small. Final cutting should be done only after a test run.

Before the motor is remounted, a minor operation must be performed on the main baseplate. The idler wheel is held in contact with the motor pulley and turntable rim by a spring and universal pivot assembly. In the original condition, the idler wheel will not move a sufficient distance to make contact with the reduced-size motor pulley. To correct this, remove the idler from its shaft, which will expose the hole in the baseplate that acts as a stop for a lug on the idler assembly. With a small file enlarge the hole in the baseplate so that the stop lug will travel about ⅛ inch farther than it would normally. Fig. 2 is a closeup view of the drive mechanism showing the essential parts at this stage. The spring which holds the idler wheel against the turntable and motor shaft has been temporarily disconnected. Replace the parts and then check the turntable rotation rate by counting revolutions, or with the aid of one of the cardboard stroboscope discs obtainable from radio supply stores. The rate probably will be a little faster than 33⅓ r.p.m. Demount the motor, remove a small amount of metal from the shaft, and then recheck the speed. From the difference in speed of the two checks, it should be possible to come very close to the required speed on the third try. Finally, polish the shaft with fine emery paper or cloth. At this point remove the top bearing

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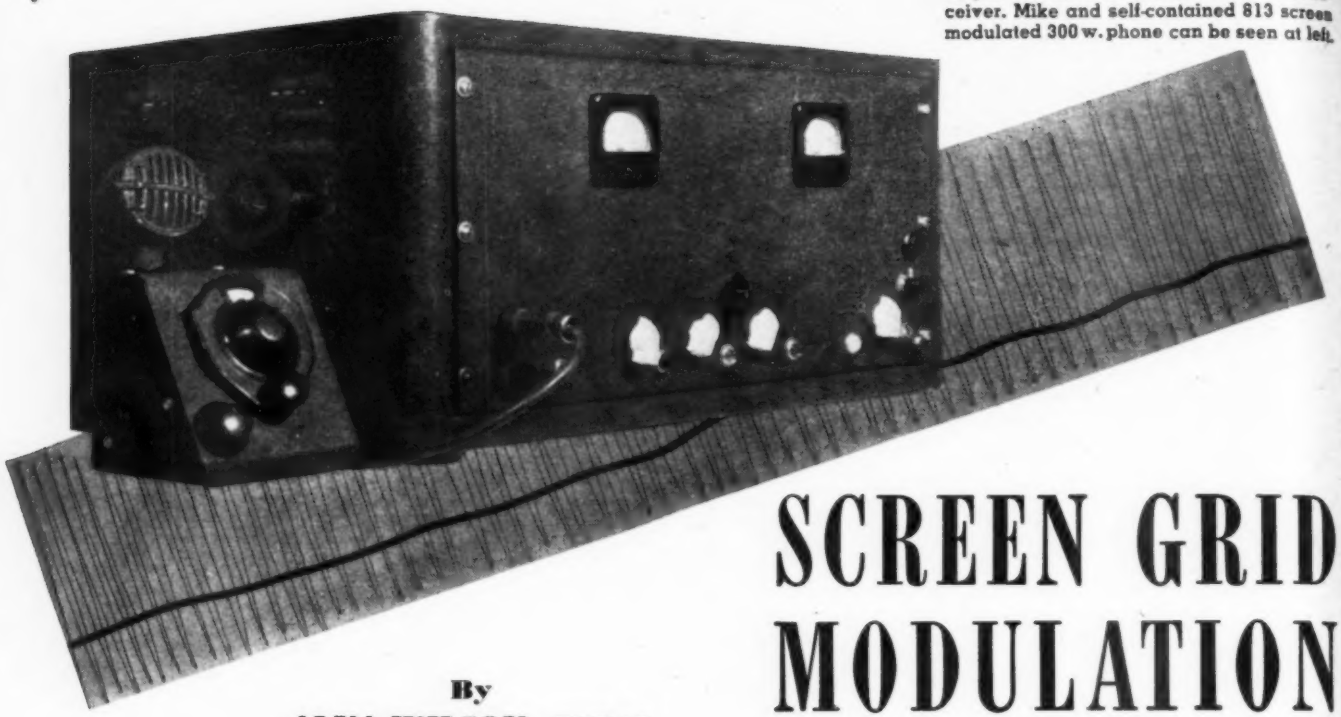

Complete station with 10 meter converter, output of which is fed into home b.c. receiver. Mike and self-contained 813 screen modulated 300 w. phone can be seen at left.

SCREEN GRID MODULATION

By
ALVA WILSON, W5DAD

A simple method for adding modulation to many c.w. rigs thus providing high power phone at low cost.

HERE is a type of high level modulation that compares favorably with plate modulation, without any of the expensive audio equipment required for the latter. A single 6V6 will fully modulate a 250-watt carrier; a pair will modulate a 500 watt carrier, or a pair of 6L6's will fully modulate a kilowatt.

The author does not know why this has not been put to practical use long ago since he first used it on phonograph oscillators for wireless record players as far back as 1929. At this time the screen of a 24 type tube was modulated by a phonograph pick-up, the 24 tube being used as an oscillator, and the output of this high impedance pickup being coupled directly to the screen grid of the 24 tube. Later a type 27 tube was added so a tone filter circuit could be incorporated in the output of the phonograph pickup without sacrificing the audio gain necessary to modulate the 24 tube screen. An old "plate to magnetic speaker" transformer was used to match the 27 tube to the screen of the 24 tube.

Later we tried screen modulating a pair of 46's and also 59's with fair results. These were the most powerful pentodes available to amateurs for several years. For the time being screen modulation was discarded, since we had to turn to triodes in order to increase our power, and after trying both grid and cathode modulation, and finding their efficiency low and the former very critical to operate as well, we had to turn to plate modulation.

To those who may think that cathode modulation is fairly new, we wish to state that in 1928 we built several record players of the wireless variety and modulated a type 27 tube oscillator by inserting the phono pickup leads directly between the cathode and ground, bypassing the cathode only for radio frequencies.

The recent war has brought out several new type pentodes and tetrodes, many of which have been placed upon the surplus market at ridiculously low prices.

Having several 807's and 813's lying around the shack with some other accumulated junk, we pondered the idea of screen modulation. Finally, unable to stand the suspense any longer, we drew up a rough diagram, gathered up an assortment of junked parts, including an 813 tube, a 1250 volt power supply, formerly used on a diathermy machine which had been discarded, a 250 volt receiver transformer for the modulation and r.f. driver section, a discarded chassis base 10"x16"x3" and the necessary resistors, condensers, sockets, etc. and started in on the old discarded idea with surprising results. By careful placement of parts we were able to place all components on the one chassis base, including the final power supply, forming a complete 250 watt, 100 per-cent modulated rig that could be slipped into an empty SX-25 receiver cabinet.

We have made many contacts on 10 and 11 meters and all quality reports were excellent. Ninety per-cent of the hams worked wanted to know the particulars of the circuit, indicating popular interest in the low construction cost and quality obtained using this means of modulation.

The first attempt was doubling in the 813 and the speech quality was poor. It was thought that we had the answer as to why screen modulation was not used, but after having put in several hours constructing the rig, we were loath to give up the idea without experimenting with it a little further. Recalling past experiences, we remembered a mobile 807 rig we had tried to modulate. It had used a single r.f. tube ahead of the 807 and the frequency tripled in the 807. Not nearly 100 per-cent modulation could be reached and the edges were very rough. We tried doubling with better results, and finally obtained excellent quality by running the 10 meter frequency straight through the 807 stage. However, this necessitated a lot of shielding etc. to get rid of self oscillation.

Following up this lead, we tried driving the 813 straight through on 10 meters with much improvement in quality. However, the sidebands were still rough when a high percentage of modulation was used, giving a result similar to one obtained when a plate modulated triode final was not properly neutralized.

This 813 amplifier would not "take off" by itself, but after giving it a bit of thought and after re-reading an article in February "QST" by Richard

M. Smith, entitled "A Stabilized 813 Amplifier," we decided to neutralize the 813 and see what happened—and presto—the quality was excellent.

Modulation matching between the audio power and screen seems to be no more critical than plate modulation, and the same type modulation transformers may be used for either system. In other words, if you are now modulating a low power rig using plate modulation you can add a pentode or tetrode final and modulate it with your present modulation equipment, without buying a lot of expensive modulation equipment, simply by removing the secondary of your modulation transformer from the present plate circuit, and inserting it into the screen circuit of your new final amplifier. To get the best results, simply load up the tube as you would for plate modulation.

The grid excitation, similar to plate modulation, must be adequate, and there is no backing off of excitation to reduce plate output as is common to grid or suppressor modulation; rather, the near maximum grid drive required for maximum plate output is to be desired for best quality of speech. Therefore, for proper operating conditions for any type tube, merely look up the tube characteristics for the particular tube you wish to use, for class C, plate modulated service, and apply them to your screen modulated amplifier.

A word about how this amplitude modulation works will not be amiss here. Upon analyzing plate modulation, we find we actually get an increase in r.f. output on our antenna when a signal is fed into the speech amplifier. This is caused by the added voltage supplied from the audio amplifier, added to the standing plate voltage on the final amplifier. Since we do not have sufficient audio voltage available for plate modulation, we must approach it from another angle—put a milliammeter in the plate circuit of a screen grid tube, and set the screen and plate at their rated voltage. Then increase the screen voltage slightly—watch the reading of the milliammeter show an increase in the plate current, then decrease the screen voltage, and watch the plate current decrease. In other words, we now have a perfect means of controlling the plate output of the tube. It is only necessary to vary this screen voltage at audio frequencies in order to produce amplitude modulation.

Since we are increasing the screen voltage on one-half of the audio cycle, it would seem that the rating of the tube would be exceeded, but such is not the case, since one-half of the cycle increases the screen voltage peak, while the other half of the cycle decreases the screen voltage peak by the same amount. This change in screen voltage is followed perfectly by the plate and 100 per-cent modulation can readily be realized. The usual increase on the antenna current meter can be observed, as well as an increase in the plate current milliammeter reading.

For those who wish to experiment further with this idea, the experimental diagram of the completed 813 transmitter as used by W5DAD in

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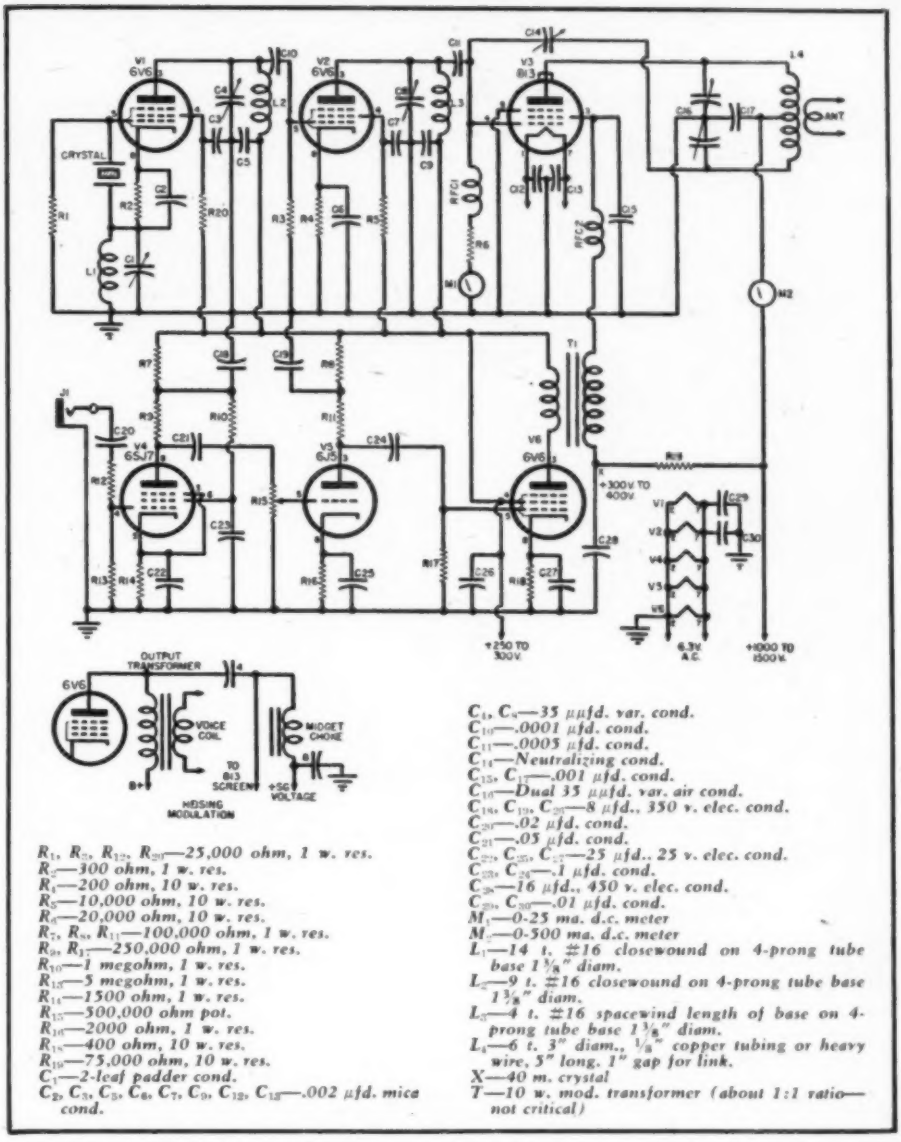
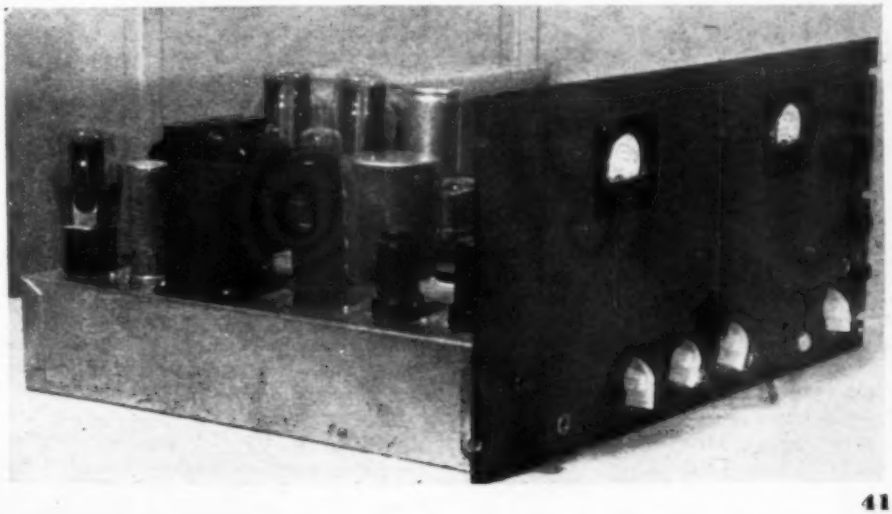


R_1, R_2, R_{12}, R_{20}—25,000 ohm, 1 w. res.
R_3—300 ohm, 1 w. res.
R_4—200 ohm, 10 w. res.
R_5—10,000 ohm, 10 w. res.
R_6—20,000 ohm, 10 w. res.
R_7, R_8, R_{11}—100,000 ohm, 1 w. res.
R_9, R_{17}—250,000 ohm, 1 w. res.
R_{10}—1 megohm, 1 w. res.
R_{15}—5 megohm, 1 w. res.
R_{14}—1500 ohm, 1 w. res.
R_{15}—500,000 ohm pot.
R_{16}—2000 ohm, 1 w. res.
R_{18}—400 ohm, 10 w. res.
R_{19}—75,000 ohm, 10 w. res.
C_1—2-leaf padder cond.
C_2, C_3, C_5, C_6, C_7, C_9, C_{12}, C_{13}—.002 μfd. mica cond.
C_4, C_{14}—35 μμfd. var. cond.
C_{10}—.0001 μfd. cond.
C_{11}—.0005 μfd. cond.
C_{14}—Neutralizing cond.
C_{15}, C_{17}—.001 μfd. cond.
C_{16}—Dual 35 μμfd. var. air cond.
C_{18}, C_{19}, C_{29}—8 μfd., 350 v. elec. cond.
C_{20}—.02 μfd. cond.
C_{21}—.05 μfd. cond.
C_{22}, C_{23}, C_{27}—25 μfd., 25 v. elec. cond.
C_{24}, C_{26}—.1 μfd. cond.
C_{28}—16 μfd., 450 v. elec. cond.
C_{29}, C_{30}—.01 μfd. cond.
M_1—0-25 ma. d.c. meter
M_2—0-500 ma. d.c. meter
L_1—14 t. #16 closewound on 4-prong tube base 1⅜" diam.
L_2—9 t. #16 closewound on 4-prong tube base 1⅜" diam.
L_3—4 t. #16 spacewind length of base on 4-prong tube base 1⅜" diam.
L_4—6 t. 3" diam., ⅛" copper tubing or heavy wire, 5" long, 1" gap for link.
X—40 m. crystal
T—10 w. mod. transformer (about 1:1 ratio—not critical)

Fig. 1. Method for applying screen grid modulation to conventional c.w. rig.

Front view of 813-screen grid modulator. The two meters are the 0-25 ma. 813 grid meter and the 0-500 ma. 813 plate meter. Miniature neon bulbs which fit the 6-volt pilot light jewel assembly are used as resonance indicators on other stages. Unmounted types are used and leads are soldered to hot side of condenser or tube plate lead. These should be mounted close with short leads.



A low-cost MOBILE STATION

By
ROBERT LEWIS
W8MQU

Front panel view of home-built converter unit. Main tuning control, C_1, C_2, is shown in center of panel.

Part 1. The converter—an easily built unit that covers both 10 and 11 meter bands. Its output connects directly to any conventional broadcast-type auto receiver. A companion transmitter unit will be covered next month.

PROBABLY nine out of ten hams have to budget their pennies in these days of high living costs, so when they come to the envelope marked "Radio Parts" they are likely to be scraping the bottom of the barrel.

This writer, after being confined to a closed room with some of his fellow hobbyists, contracted a bad case of "mobilitis." The biggest problem to be solved was how to acquire a mobile rig and have beans on the table at the same time. After digging out the slide rule and some radio catalogues, the writer calculated that the cost of manufactured equipment would make a dent in $150 that would leave just about enough to get a battery charge. Hence the decision to construct the station at home. Anyway it's more fun to build your own gear.

Naturally you can't work anyone unless you can hear him, so the first project was to build a converter to work into the car radio. It is assumed that most hams who own cars have standard broadcast radios therein. A number of circuits were considered, along with the available space in the car, and other factors. The one-tube converter circuit of Fig. 1 got the nod. The circuit was developed around a 6BE6 miniature pentagrid converter tube, which has characteristics similar to those of the 6SA7. Of course the small size of the tube was the determining factor in using the 6BE6. A look at the circuit will show that it is straightforward in design. The converter tunes from the low end of the 11 meter band to the high end of 10, or about 27 to 30 mc. In this particular instance the oscillator was set to tune on the low frequency side of the mixer. The output frequency was fixed at 1600 kc. so that it might be fed into a standard broadcast receiver. Plate and filament voltages are supplied by the car radio. It was deemed advisable to use a voltage regulator to stabilize the screen voltage. For this job the miniature OB2 was chosen. The 6-volt supply in an automobile varies somewhat, depending on the output of the generator. Therefore the voltage regulator was incorporated to minimize resultant plate voltage changes. Total plate current drain in the converter, including OB2 current, is about 17 ma. The filament operates at 0.3 amp. It will be noted that transmitter controls are also incorporated into the receiver, which is built into a standard 4 x 5 x 6-inch utility box. The jack at the left is a standard PL68 jack into which is plugged a T17B carbon microphone or any other carbon mike having a built-in push-to-talk switch. The pilot light at the center of the receiver cabinet indicates when 6 volts is applied to the transmitter dynamotor. The rotary switch at the right performs two functions. When thrown to the right, 6 volts for converter and transmitter filaments and relay coil are applied; at the same time the antenna is connected to the converter input circuit, and the lead to the broadcast antenna is switched to the converter output transformer. Throwing the switch to the left removes all filament and relay voltages and bypasses the antenna directly to the broadcast receiver for standard broadcast reception. Of course the push-to-talk switch on the microphone must be depressed in order to actuate the transmitter relay. All connections from the receiver to the transmitter are made to a terminal strip on the rear of the converter cabinet, while filament and plate voltage leads and antenna leads to the broadcast receiver are of single-conductor shielded wire.

It will be noted that the converter mixer and oscillator coils are wound

on slug-tuned forms. This feature makes it a simple process to adjust the coils to their proper inductance. Tuned circuits are wired with 16-gauge solid wire, which gives better oscillator stability against mechanical vibration than stranded wire. The balance of the wiring incorporates stranded wire. Due to the vibration to which the equipment will be subjected, all parts are mounted rigidly. Low impedance antenna leads are shielded, as are all leads entering the cabinet, the latter precaution being taken to prevent noise pickup. In calculating the value of the screen resistor, R_2, the plate supply voltage from the broadcast set must be known. For example let us consider the case in question. The supply voltage was measured at about 178 volts with the car running and the generator supplying about 20 amperes. The voltage drop within the OB2 over a wide current range is 108 volts. Thus a drop of 70 volts was required across R_2, with normal 6BE6 screen current of 7 ma., and OB2 current set at 10 ma. for stable operation. Applying Ohm's law results in a resistance value of about 4000 ohms. If the supply voltage should be higher than this, then a higher value of screen resistor should be used. Although the OB2 will handle 30 ma., an operating current of about 10 ma. is sufficient for stable operation, and, of course places less drain on the broadcast receiver power supply.

The most critical adjustments necessary are the settings of the slugs in the r.f. and oscillator coils and also the padding condensers, C_2 and C_5. The coils should be wound exactly as specified in the parts list for best performance, as considerable time was spent on the original unit adjusting the coils for optimum antenna coupling and oscillator feedback. Prior to construction, calculations were made to determine relative values of L and C required to insure tracking of the two tuned circuits. Figures indicated the oscillator padder should be set at 12 $\mu\mu$fd., or about ½ total capacity (if a 25 $\mu\mu$fd. padder is used, as indicated), while mixer padder C_2 should be set at about 10 $\mu\mu$fd. After setting the padders as close as possible to these

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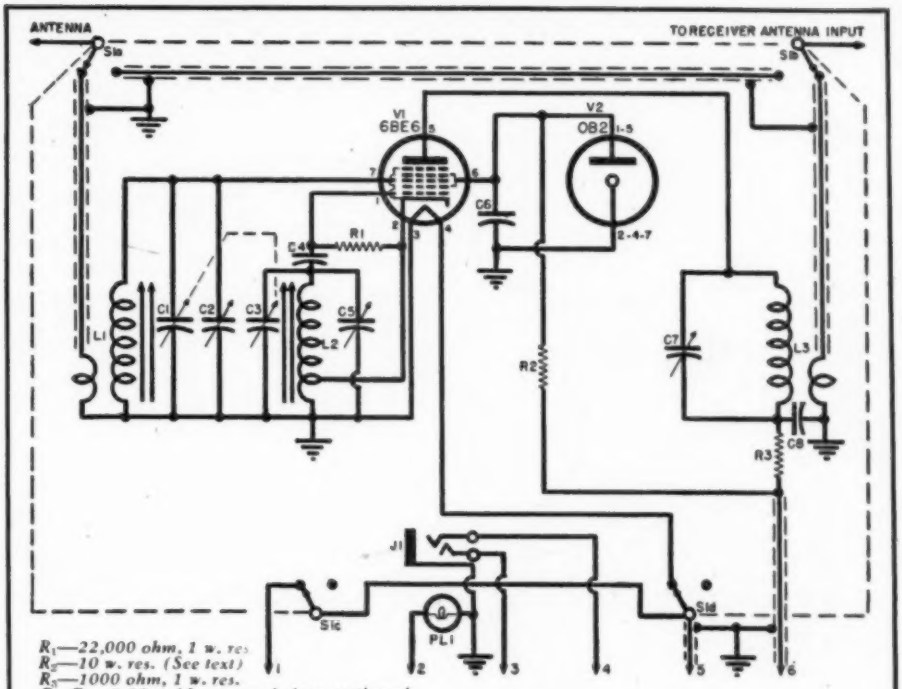
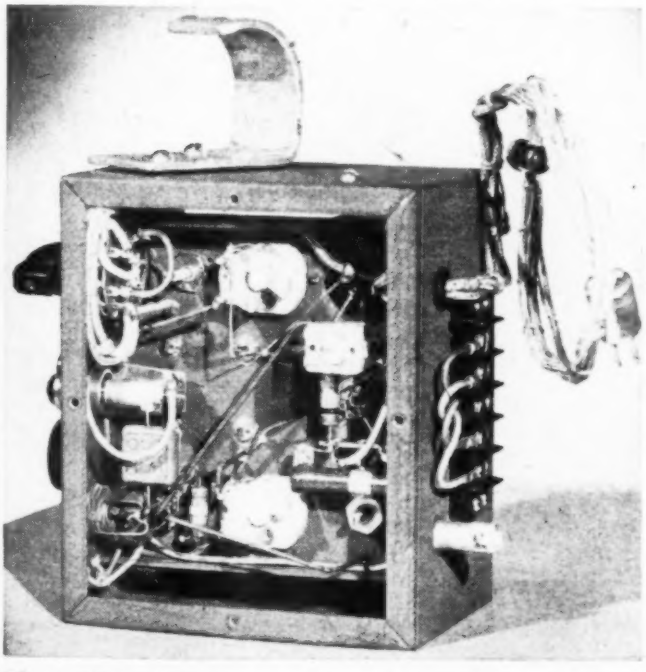


R_1—22,000 ohm, 1 w. res.
R_2—10 w. res. (See text)
R_3—1000 ohm, 1 w. res.
C_1, C_3—1-10 $\mu\mu$fd. var. cond. (one section of Cardwell "Trim-Air")
C_2, C_5—25 $\mu\mu$fd. air padder cond.
C_4—50 $\mu\mu$fd. silver mica cond.
C_6, C_8—.001 μfd. mica cond.
C_7—3-30 $\mu\mu$fd. mica trimmer cond.
L_1—10 t. 22 wound to fill National XR50 slug-tuned coil form. Ant. coil 3 t. interwound with bottom three turns of grid coil
L_2—10 t. 22 wound to fill National XR50 slug-tuned coil form. Cathode tap 2 t. from ground end
L_3—1600 kc. output trans. Standard b.c. ant. coil with normal grid winding as primary and normal ant. winding as secondary. Tuned to 1600 kc. with C_7
PL_1—6.3 v. pilot light (indicates when 6 v. is applied to dynamotor in transmitter)
J_1—PL-68 jack
S_1—4-circuit, 2-pos. rotary wafer sw. (Mallory shielded type)
1—6BE6 tube
1—OB2 tube

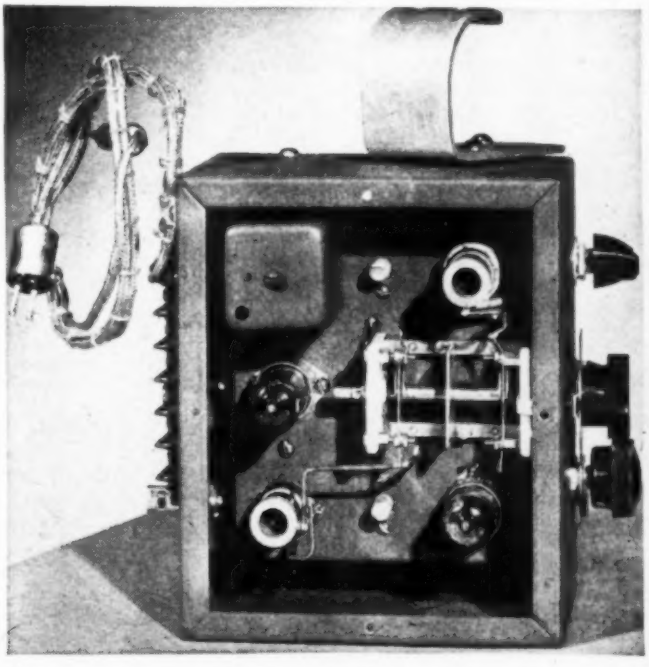
Terminal Connections—1—To transmitter fil. and relay coil (hot side); 2—To 6 v. hot connection on dynamotor; 3—To low side of transmitter relay coil; 4—To microphone transformer input connection; 5—To 6 v. supply from car radio; 6—To 250 v. supply from car radio

Fig. 1. Complete schematic diagram of converter unit. The switching arrangement shown is based upon its use with the companion transmitter covered next month.

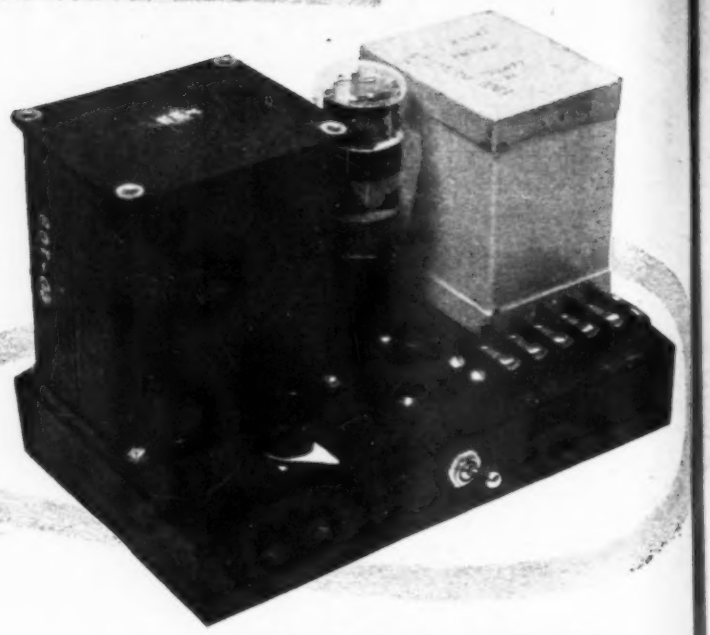
Under chassis view of the converter unit used with auto radio.



Top chassis view of the same unit with protective cover removed.



Novel Controlled RECTIFIER



Over-all view shows construction details of home-built rectifier unit.

By
S. S. PESCHEL

Experimenters, servicemen, and hams can build this simple unit from available junk box parts.

MANY attempts have been made to obtain a variable output from a simple rectifier power supply. Old timers will recall the "B" eliminator which featured one or two variable output potentiometers.

Another old stunt[1] used a rheostat in series with the input condenser of a filter in order to obtain a variation in output voltage between the extremes of the voltages obtained with condenser input as a maximum and with choke input as a minimum.

Other methods for obtaining this variable output were described in the author's article "Power Supply Output Voltage Control" (RADIO & TELEVISION NEWS, October, 1948). Complex and expensive power supplies with variable output are available but lack the desired simplicity of construction.

The previous control unit[2] functioned as an electronic rheostat which could be added to any standard power supply. It involved the use of a control tube plus a rectifier tube, within the standard power supply. The controlled rectifier to be described in this article contains only one tube, and, as the name implies, is both a rectifier and a control tube. See Fig. 1A.

The new circuit will be recognized as the control tube previously described except that it is now supplied with a.c. instead of d.c. The principle of operation has already been covered.[2] An inspection of the basic circuit will suggest an obvious improvement, namely, the use of a full-wave rectifier. See Fig. 1B.

The requirements of this circuit call for the use of a heavy twin-triode or the use of two tubes in a full-wave arrangement. Based on previous experience, the following tubes were tried; a 6AS7G, an 829, a pair of 1625's (12 volt 807's), and a pair of 6L6's.

The 6AS7G with its low plate resistance of 280 ohms at 125 ma. plate current per triode section, introduces a tube drop of approximately 35 volts at zero bias. Standard rectifier tubes such as the 5U4G, 5Z3, 5Y3, etc. run approximately 58 to 60 volts tube drop per section at the rated current per plate.

The different tube types were tested in a conventional rectifier/filter circuit which employed a standard radio-type power transformer. The tabulation of Fig. 2 shows the results obtained using the 6AS7G, a pair of 1625's, and a pair of 6L6's.

From the tabulated data of Fig. 2, it can be seen that the 6AS7G is advantageous in applications where low tube drop is important and where control range is a secondary consideration. Other tubes, the 829, 807, 1625, 6L6, etc., are better from the standpoint of greater control range but they have a higher internal resistance. At medium load currents, at 100 ma. or so, they are quite satisfactory. At higher currents the 1625's appear to have lower tube drop than 6L6's. The 829, not shown in the tabulation, generally runs quite a bit better than the 1625's.

Several power supplies using the various tube types have been constructed and placed in operation. One of the units, shown in the photograph and diagramed in Fig. 3, uses the 6AS7G as the controlled rectifier. A standard radio-type power transformer and filter circuit is used. The simple grid control is the output potentiometer scheme described previously.[3]

The parts list of Fig. 3 includes the components used to construct the unit shown in the photograph. The individual constructor may have on hand power supply components which differ

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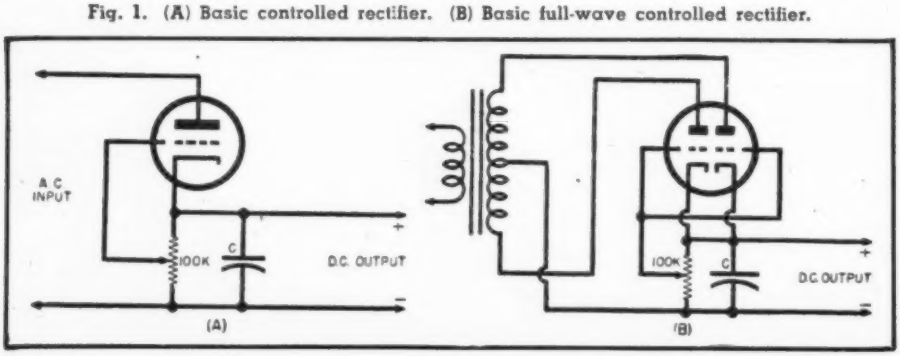
Fig. 1. (A) Basic controlled rectifier. (B) Basic full-wave controlled rectifier.



[1] "Hints and Kinks," QST, June, 1939, page 51.
[2] Peschel, S.S.; "Power Supply Output Voltage Control," RADIO & TELEVISION NEWS, October, 1948.

CUSTOM-BUILT TELESETS Provide New Video Market

By AUSTIN C. LESCARBOURA

One type of custom-built installation which has found wide acceptance with televiewers.

Built-in television receivers provide business executives with up-to-date news coverage and radio servicemen with a new source of income.

A NEW and virtually untapped market for television receivers is awaiting the alert merchandiser. What tavern television did for the then-infant video industry, the custom-built office installation may repeat in the form of increased sales.

Office television offers almost infinite possibilities. The busy executive can "telelook" or take a peek at the world without leaving his desk or comfortable swivel chair. He can open his drawer, flip a switch, turn a knob, and he has the baseball game, news events, the political campaign—all within the confines of his office.

One such installation, in the office of Dr. Allen B. DuMont, pioneer television worker and manufacturer, is shown on this month's cover.

There is nothing particularly unusual about office television except that most executives haven't begun to think of television in terms of the business office. Years ago they would send the office boy out to buy the afternoon newspapers in order to get the latest news, stock reports, business information—and perhaps a sneak look at the sports pages. Later the office radio set came into use, providing coverage of news events and important happenings.

Now, late in 1948, the executive can have the world at his doorstep with a television receiver in his office. It can be a standard table model video set or a console receiver but of course the refinement is the standard custom model which mounts in the office wall and out of the way.

The *DuMont* standard custom teleset comprises a large angle-iron framework supporting the various chassis and loudspeaker which is placed behind the office wall. The 20 inch picture tube is framed on the wall. The tuner and controls, however, are located remote from the receiver but at the fingertips of the operator for maximum convenience and comfort. In Dr. DuMont's office installation, the compact control unit is placed in a desk drawer.

The Inputuner, standard in all *DuMont* telesets, provides for continuous tuning throughout the entire TV and FM bands, or from 44 to 216 mc. in one continuous rotation of a single knob with illuminated dial. The compact control unit also includes a tuning meter for accurately tuning in the chosen channel. Volume and video contrast controls, the "on-off" switch, and a switch for cutting in the control either at the remote control unit or at the receiver proper are included.

In order to obtain an intense image that can be readily viewed in the sunlit office, the usual cathode-ray tube potential of 15,000 volts has been stepped up to 23,000 volts. The control unit transmits the composite video-audio signal to the receiver proper, via a suitable cable, along with the essential control functions. Other controls are at the receiver proper. Since the control functions are handled at the viewing distance from the television screen, quicker and better adjustments are possible with this remote type of operation.

Custom installation work is not too complex as such units are shipped from the factory ready to install, with all chassis, controls, and screens ready to be built into the wall, furniture, or other cabinet.

Servicemen and dealers might investigate the possibility of increasing their incomes by offering such custom service to their clientele. This type of service can prove to be both pleasant and profitable, and an enthusiastic customer for office television can become a real asset to you in the form of increased business. An executive office "showroom" for your work can result in a nice boost in your income.

—30—

Fig. 1. United States Television's sweep generator.

How to Use SWEEP GENERATORS With TV RECEIVERS

A discussion of the techniques to be employed in using sweep generators in the servicing of video receivers. Analysis of results is also discussed.

ONE of the most important aspects of television service work is the visual alignment of the i.f. and r.f. circuits in television receivers. The equipment required for this job consists of a sweep signal generator to produce the signal and an oscilloscope to indicate visually the response pattern of the circuit through which the signal has just passed, By studying the shape of this final curve we can determine whether the circuit under test is properly aligned.

To use both instruments to their fullest extent, the serviceman must be able to properly attach the signal generator to the receiver under test and he must be able to interpret the patterns that appear on the scope screen. The patterns, in turn, will depend upon the circuit under test and the type of signal generated in the sweep oscillator. The latter half of the preceding statement is most important and yet it is not adequately understood by many servicemen. It is common belief among many servicemen that the response curve for any one particular circuit—as viewed on a scope screen—will be always the same no matter what type of sweep generator provides the signal input. *This need not be true unless the sweep generator and the indicating oscilloscope are properly used.* Various sweep generators *can* produce different patterns on the screen even though applied to the same network. However, if correctly employed, each type of sweep generator output *will* produce the same response pattern when applied to the same circuit. The problem, then, is to understand how the frequency output of each type of sweep generator varies, what effect this has on the circuit under test, and what must be done to obtain the correct response pattern on the screen.

The number of commercial sweep signal generators designed specifically for television use is limited. Those that are available employ either a sinusoidal frequency variation or a saw-tooth frequency variation.

Sinusoidal Frequency Variation

A signal generator in which the output frequency varies in a sinusoidal manner is the *U.S.T.* unit shown in Fig. 1. To understand this frequency variation, consider the sine wave shown in Fig. 2. At the start of the sine wave, point *A*, the oscillator stage in the sweep generator unit is producing a certain frequency signal. Let us say this is 23 mc. Then, at time *A*, the signal frequency output of the generator is 23 mc. However, this is true only momentarily. At the next instant, the modulating or driving voltage within the sweep generator is swinging the frequency of the generator toward 25 mc. and, at time *B*, the generator output has reached 25 mc. During the next interval of time, the internal driving voltage within the generator causes the output frequency to drop down to 23 mc. This is the output frequency at time *C*.

Following the path of the sine curve of Fig. 2, the generator output frequency continues to decrease to 21 mc., stopping here and gradually returning to 23 mc. One complete cycle has now been completed and similar frequency variations will be repeated for as long as the equipment is in use. The front dial of the instrument would be set to a frequency of 23 mc. (the mean frequency) and the "frequency sweep" dial would indicate 4 mc. Thus, the over-all sweep would be (23 mc.–2 mc.) or 21 mc. to (23 mc.+2 mc.) or 25 mc. The difference between the highest and lowest frequencies of the sweep is 4 mc.

Now, let us apply this frequency-modulated signal (for that is what it is) to the tuned circuit shown in Fig. 3A. An oscilloscope will receive the output voltage appearing across this circuit and, if properly connected, should produce on its screen the pattern shown in Fig. 3B.

The internal deflection voltage of the scope is a saw-tooth voltage, as shown in Fig. 4. This is the voltage which is ordinarily used to swing the beam across the screen. The beam, under the influence of this saw-tooth voltage, starts at the left-hand side of

the screen and progresses at an even, steady rate toward the right. This corresponds to the rise in deflection voltage from *A* to *B*. When the deflection voltage attains the voltage value of point *B*, the beam will be at the far right-hand side of the screen. From *B* to *C* the voltage drops sharply and the electron beam swings back rapidly to the left-hand side of the screen. Each saw-tooth cycle is repeated in like manner.

Now, it is possible to connect a sweep generator, whose output frequency varies sinusoidally, to a circuit and to observe the response of this circuit on a scope screen where the beam is deflected by a saw-tooth voltage. However, this results in a distorted pattern (as we shall see later) and it is best to use a sine wave deflection voltage for the electron beam. Therefore, turn off the horizontal sweep deflection voltage developed in the oscilloscope (by turning the frequency knob to the "off" position) and substitute a sine wave voltage obtained from the front panel of the sweep signal generator. Outlet terminals, provided on the front panel of the sweep generator, make available a portion of the same 60 cycle voltage driving the generator. This voltage is applied—through a coaxial cable or a pair of twisted leads—to the horizontal input terminals of the oscilloscope. The deflection of the electron beam will now follow a sinusoidal motion, which differs markedly from its motion under the influence of a saw-tooth wave. Its action is as follows. (Assume the sine wave voltage of Fig. 5 is applied to the horizontal deflection plates of the scope cathode-ray tube.)

At time *A*, the deflection voltage is zero and the electron beam passes unmolested through the deflection plates and strikes the center of the scope screen. From *A* to *B*, the sine wave voltage is increasing, forcing the beam to move to the right side of the screen. At time *B*, the beam is as far to the right as it will travel and stops momentarily. As the voltage decreases from *B* to *C*, the beam starts moving back toward the center of the screen, at first slowly and then picking up speed until, by the time the deflection voltage has reached point *C*, the beam is at the center of the screen and moving quite rapidly to the left.

From *C* to *D*, the leftward travel continues although the beam slows down as the far left-hand side of the screen is approached. When the deflection voltage reaches the value of point *D*, the beam is as far to the left as it will go and it stops momentarily. Then under the pressure of an increasingly positive voltage (from time *D* to *E*), the beam begins to travel toward the center, picking up speed until, at the center, it is traveling at its maximum rate of speed toward the right. This completes one cycle; successive cycles will produce identical motion.

Note carefully the difference in beam motion when the deflection volt-

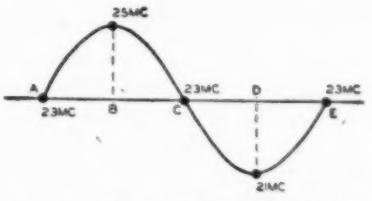


Fig. 2. The manner in which the signal output of U. S. Television's generator (shown in Fig. 1) varies.

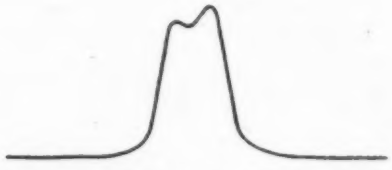


Fig. 8. The result of the action described in Fig. 9 as this result appears on the screen of the oscilloscope.

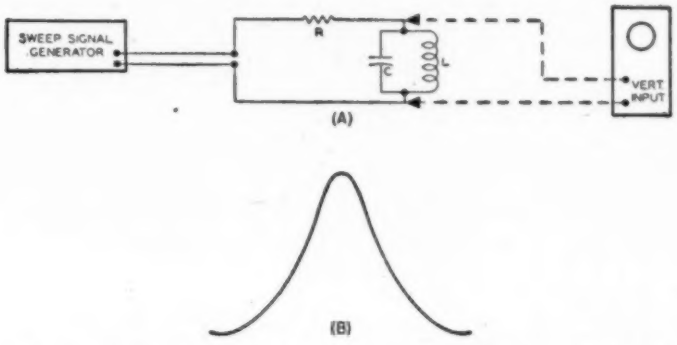


Fig. 3. (A) The application of a frequency-modulated signal to a tuned circuit. (B) Response of circuit as it appears on oscilloscope screen.

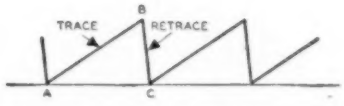


Fig. 4. Saw-tooth deflection voltage generated internally at the scope.

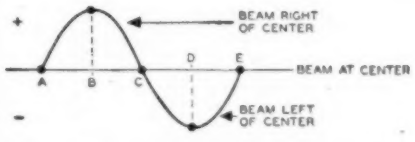


Fig. 5. Motion of electron beam under influence of sinusoidal deflection voltage.

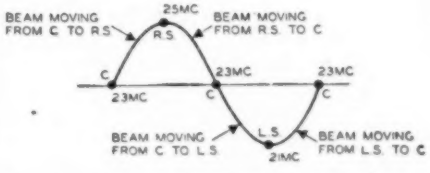


Fig. 6. A composite diagram indicating how the beam and the sweep generator output signal vary in step, sinusoidally.

Fig. 7. When the sweep frequency of the generator and the electron beam in the scope both vary in the same manner, the frequency spacing of the response pattern will always be linear, as shown.

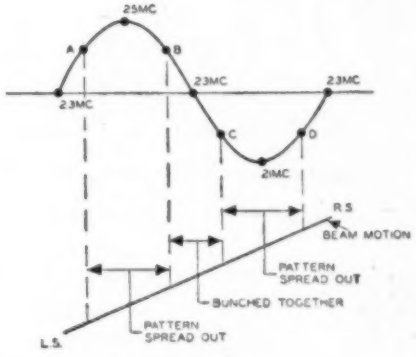


Fig. 9. A sinusoidal frequency variation coupled with a linear saw-tooth beam motion will produce a pattern that is bunched together in the middle region and spread out at both ends.

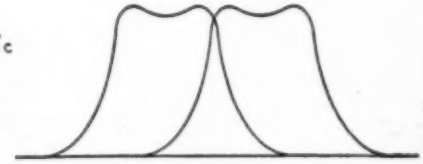


Fig. 10. A double pattern of Fig. 7 due to an improper phase control setting.

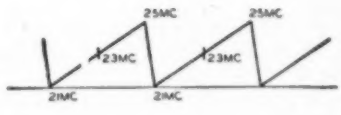


Fig. 11. A linear variation in output frequency from a television sweep generator, i.e., the Kay Electric "Mega-Sweep" shown in Fig. 12.

Fig. 12. A sweep signal generator using a single saw-tooth sweeping voltage. This unit is the Kay Electric Company's "Mega-Sweep."

age is changed from a saw-tooth to a sine wave. With saw-tooth deflection, the electron beam travels from left to right at a steady rate of speed. At the far right-hand side of the screen, the beam retraces rapidly to the left. Generally this motion is so rapid that the retrace line is not visible. With sine-wave deflection, the beam is always visible. There is no rapid retrace such as we find with saw-tooth deflection. The speed of the beam varies from point to point in its path. At the far ends of the path the speed is at its lowest value; at the center of its path the beam travels fastest. The reader will recognize this motion as similar to that of a pendulum swinging back and forth.

It is now possible to combine the motion of the electron beam across the scope screen with the signal frequency variation of the sweep generator. The composite diagram is shown in Fig. 6. The numbers at each point represent the frequency of the signal applied to the circuit under test; the letters indicate the position of the beam on the screen. To save space, the following abbreviations have been used: C = center of screen; $R.S.$ = right side of screen; $L.S.$ = left side of screen.

When the same type of driving voltage is employed in the sweep generator and in the scope, the frequency spacing of any pattern appearing on the screen will be linear, i.e., spaced at equal intervals. See Fig. 7. (It is understood, of course, that these frequency figures do not actually appear on the scope screen.) The reason these frequencies are all evenly spaced arises from the use of the same driving voltage both in the signal generator and in the cathode-ray oscilloscope. Thus, when the frequency is changing slowly at the signal generator output, the beam is moving slowly across the screen. On the other hand, when the frequency is changing rapidly along the slopes of the sine wave driving voltage, the beam is moving rapidly across the screen. In this manner, a 1 mc. frequency change when the signal is shifting slowly will occupy as much space on the scope screen as a 1 mc. change when the signal frequency is changing rapidly. This will always be true when the beam and the sweep generator are controlled from the same source. *It will not be true if the voltage driving the beam is of one type and the voltage modulating the sweep generator is of another.* Remember this, for it is most important in all servicing and alignment work. A simple illustration will readily demonstrate what would happen to the response curve if the sweep generator has a sinusoidal frequency variation and the oscilloscope employs its internal saw-tooth deflection voltage. To simplify the discussion, we will assume that one cycle of the 60-cycle voltage occurs in the time of one saw-tooth wave. Consequently, the beam will travel across the screen at a steady pace whereas the frequency output from the generator will sometimes change rapidly and sometimes slowly. Thus, at times we would expect the response curve to be bunched together while at other times it will be spread out. This is revealed graphically in Fig. 9. From point B to point C of the sine curve there is a faster frequency change than from A to B or C to D. Hence, during the period from B to C, more of the response curve will be traced out because the signal frequency is changing most rapidly. During the intervals, A to B and C to D, the frequency is changing slowly and that portion of the response curve that is traced out will be spread out on the screen. Visually we would see the curve shown in Fig. 8.

Nearly all sweep generators that employ a sinusoidal frequency variation contain a control on their front panel marked "Phase Control." The purpose of this control is to permit adjustment of the 60-cycle driving voltage until one pattern appears on the screen. Many times, a double pattern, such as shown in Fig. 10, is obtained; however, by adjusting the "Phase Control," the two curves can be made to blend into one. Double patterns are due to the fact that although the driving voltages for the beam deflection and the sweep generator are taken from the same source, it does not necessarily follow that these voltages are still in phase with each other by the time they actually reach the beam deflection plates in the scope or the modulator tube in the sweep generator. Through the action of the phase control, it is possible to bring these two voltages into phase with each other at their point of application.

Television sweep oscillators may also use a saw-tooth driving voltage, similar to the voltage shown in Fig. 11. Note that it is precisely the manner in which the electron beam moves when the internal deflection voltage of the oscilloscope is employed. The output frequency of this generator changes linearly, as shown in Fig. 11, from the lowest to the highest frequency. When the 25 mc. frequency is reached, the signal is suddenly returned to 21 mc. again to start the slow, linear rise again. One such generator, the *"Mega-Sweep"* shown in Fig. 12, has an output frequency range from 50 kc. to 500 mc. on fundamentals. A maximum frequency sweep of 40 mc. is available, although this can be reduced to 30 kc. A portion of the saw-tooth voltage used to sweep the frequency can be obtained from the terminals on the front panel of the generator and used to synchronize the horizontal deflection system in the oscilloscope. Or we can use the sweep

(*Continued on page* 180)

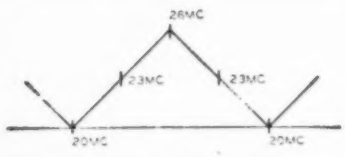


Fig. 13. With a double saw-tooth sweep, the frequency variation would be as indicated here.

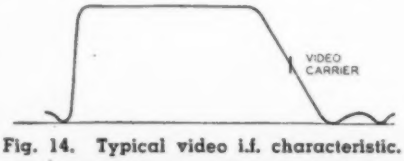
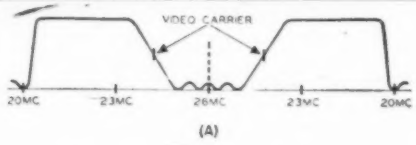


Fig. 14. Typical video i.f. characteristic.



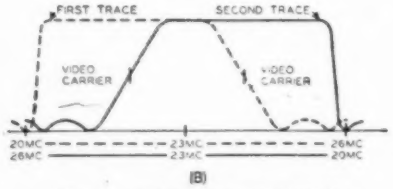


Fig. 15. Two types of double patterns produced by double saw-tooth variation of Fig. 13.

SELL YOUR SERVICE

By
JOHN B. LEDBETTER

A radio service shop may be gradually expanded to include service and sales of electric appliances.

Increasing your shop income is a matter of careful planning and the strategic handling of customers.

THE rapid strides which have been made in the past few years in u.h.f. communications, FM, television, and other phases of radio and electronics have been and will continue to be phenomenal. As a result, higher and more exacting standards have been placed on servicing technique *and on selling technique.* To meet these requirements the serviceman must adopt both immediate *and* long-range plans which will result not only in keeping his shop and test bench up-to-date, but will also encompass a continued broadening of his technical education, improvements in servicing methods, *and the acquiring of a more advanced sales technique!*

Since the radio service field is daily becoming more complex and more competitive than ever, it may well be that "survival of the fittest" will depend to a large degree on the serviceman's ability to *sell.* This means he must be able to sell more than a *repair* job—he must be able to sell convincingly his service and business methods—the major and minor points which make his service superior to that of his competitors. Above all, he must be able to sell *himself!*

The prime requisite for success in any business is a large number of satisfied customers. Perhaps the most effective formula in the entire service field (and certainly the most welcome) insofar as the serviceman himself is concerned, may be summed up as: $R_r/B_a :: C_s/S$, where R_r = cash register receipts, B_a = bank account, C_s = satisfied customers, and S = the shop. Stated another way, it may be said that "the level of income is directly proportional to the number of active (satisfied) customers."

Before we analyze our service technique and business methods, it might be well to study some of the more basic points which are necessary not only in creating a satisfied feeling on the part of the customer at the way in which service on his set was performed, but in causing him to recommend your service to others. Years ago, Dale Carnegie wrote a highly successful book "How to Win Friends and Influence People." Perhaps you have read it. Suppose we borrow a bit from Mr. Carnegie and write our *own* set of rules. These, quite appropriately, could be listed under the heading of "How to Win Customers Who Influence People." Word-of-mouth advertising is one of the most effective methods of increasing your popularity and business income; take advantage of it. Do your utmost to see that your *customers* have good reason to use it. *One* satisfied customer may have direct influence on scores of new customers or prospects.

Now, let's find out what *makes* a customer satisfied. The number *one* reason, of course, is because you did a good job on his radio! But—that isn't all! Chances are, you know a half dozen servicemen who could have done the job equally well—in many cases, so does the customer! To make that customer remember *you* the next time his receiver needs attention, you must do a good job of selling *yourself!* Many times that part may be done subconsciously, as far as you are concerned, but for lasting customer impression and repeat business it must be accomplished *just the same.* If you can influence the customer subconsciously, well and good, but most of us have to expend a good deal of *conscious* effort in order to turn the trick.

Here are some of the points a customer likes to remember: (1) a pleasing personality, (2) a neat, attractive shop, (3) honesty, (4) dependability, (5) straightforwardness, (6) politeness, (7) efficiency, (8) fair service charges, and (9) an atmosphere which makes him "feel at home." Note that a "pleasing personality" is listed as first in importance. This, along with a neat, clean shop, is the first thing the customer notices. Most of us have a tendency to make snap judgments; the customer is no exception. If your manner is disinterested, cool, or impersonal, the customer may go elsewhere next time. You may be worried or pre-occupied with a problem or wondering where next week's rent is coming from, *but* the customer doesn't know this. He instantly receives the impression that you'd just as soon not bother with him. Develop the habit of listening to his "troubles," no matter how unimportant or inconsequential they may seem. Display a personal interest in his problems. It isn't necessary to develop the bubbling enthusiasm of a Clark Gable or Van Johnson—just be yourself. This point brings up another of Mr. Carnegie's suggestions—let the *customer* do most of the talking. Intelligent listening not only reveals important personal traits of the customer which can be used to good advantage but also impresses him further.

In like manner, the first impression a prospective customer receives on en-

(*Continued on page* 114)

The RECORDING and REPRODUCTION of SOUND

By

OLIVER READ
Editor, RADIO & TELEVISION NEWS

United Transformer Corporation's Type EG-1 interstage equalizer.

Part 21. Continuing the discussion of various means of audio frequency correction for specific applications.

IN OUR article last month we discussed many types of tone controls (equalizers) employing resistance and capacitance. Greater flexibility is had with the "resonant" type of equalizer, as it has been found from actual listener tests (see Fig. 1) that to obtain a balance between the low and high frequency response is highly desirable. For best performance, the product of the low frequency and high frequency limits of the equipment should equal approximately 500,000.

It has been established that where an audio system in a receiver was good to only 200 cycles at the low frequency and a tone control was necessary and when it limited the high frequency end to 2500 cycles the best balance of response was obtained. In the reproduction of phonograph records a similar condition exists, especially those records having a sharp drop-off at the low end. Accordingly, to obtain balance the high end frequencies are often removed unnecessarily. While the sound becomes balanced to the ear the fidelity is, unfortunately, greatly decreased. Low notes which were not reproduced originally are still not reproduced, and the high notes are missed as well. The obvious answer then is to bring back the low notes through the use of an equalizer, thus increasing the over-all fidelity rather than reducing it.

Virtually all recording systems, whether discs, sound on film, sound on wire, embossed film, etc., require playback equalization as well as equalization when the recording is being made. The necessity for equalization is apparent.

Most microphones, pickups and loudspeakers can be effectively equalized. Low frequency droop used for dialogue equalization will greatly improve the intelligibility of speech. It will also permit higher power levels from speakers used in p.a. equipment. A portion of the power normally going to the speakers and not required for intelligibility is removed.

Mid-frequency equalization (low end and high end droop) is frequently used by radio amateurs to effect a maximum signal level in the frequencies most necessary for intelligibility. Various acoustic conditions will frequently lend themselves to equalization. For example, the absorption of high frequencies may easily be 15 db. depending upon the drapes in the room, the number of people, as well as the presence of any other sound absorbing material. Another point of equalizer use comes from the realization that at low sound levels the ear is less responsive to low frequencies. This type of equalization is commonly called "bass boost."

In order to obtain smooth and positive control and not introduce hum into the audio circuits it is advisable to employ commercially made equalizers such as the CGE-1 developed by *U.T.C.* engineers. Reference to the curves will show how well such units are suited to many applications. The electrical components are stable, free from hum pickup, and dependable in operation.

This type of equalizer is readily adapted for use with commonly used audio amplifier equipment. As mentioned, the frequency correction curve with the *RC* type of tone control is a gradual slope and does not accomplish what is required in the boost condition. For example, if the circuit to be equalized is down 15 db. at 5000 cycles, an equalizer which brings back this 15 db. but also boosts 6 db. at 1000 cycles is not desirable. Accordingly, the CGE-1 unit employs resonant circuits for both the low and high frequency boost. As will be noted from the curves with 15 db. boost at 8000 cycles the response curve is flat at 2000 cycles. A similar condition exists at the low end. Two controls are required, one either boosts (accentuates) or drops (attenuates) the low frequencies and the other either boosts or drops the high frequencies. This type of equalizer is of high impedance and is designed for insertion into an audio amplifier between a triode plate and subsequent grid, or from a high impedance source (5000 to 30,000 ohms) other than a crystal microphone, to a subsequent grid loaded with 10,000 ohms.

Some insertion loss is effected by this equalizer, particularly at the maximum setting. If the amplifier system does not have excessive gain an additional audio stage may be required. As the filament and plate drain of the added tube is small, it

(*Continued on page* 157)

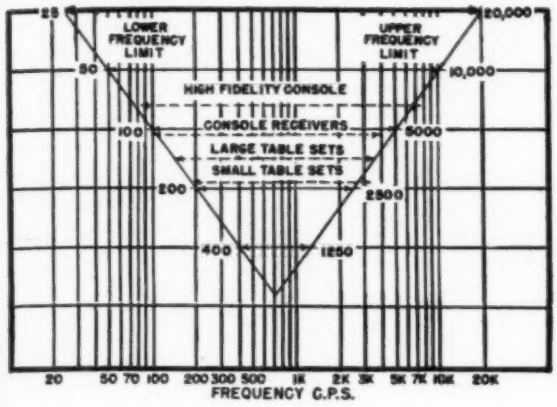


Fig. 1.

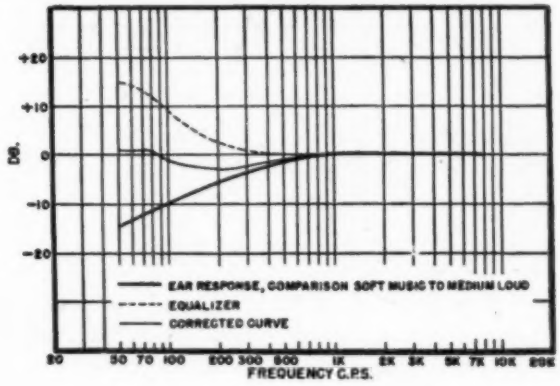


Fig. 2.

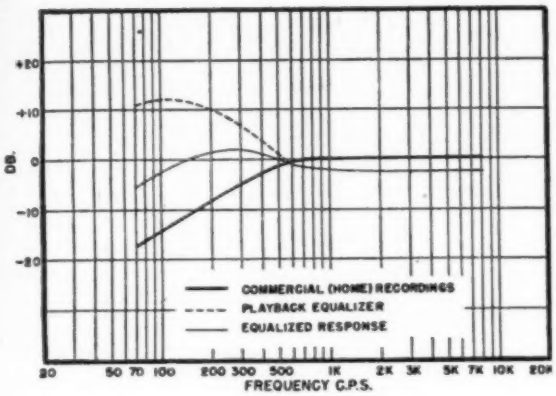


Fig. 3.

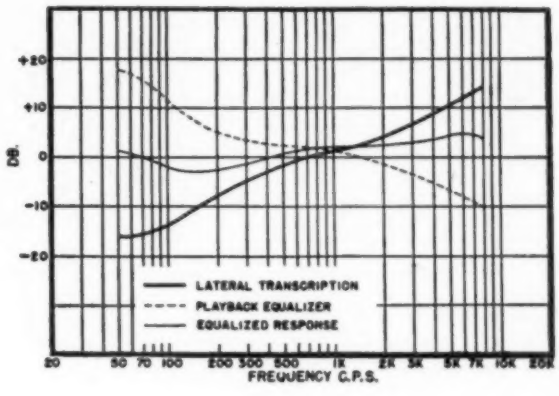


Fig. 4.

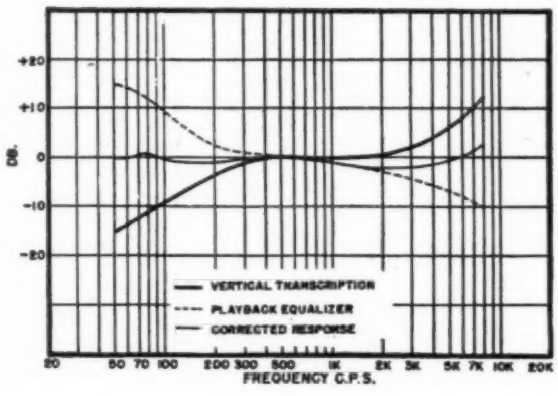


Fig. 5.

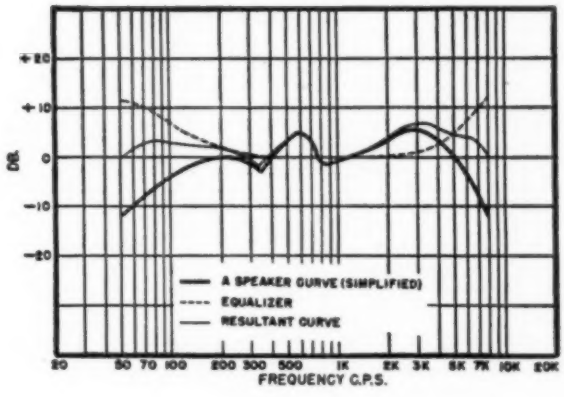


Fig. 6.

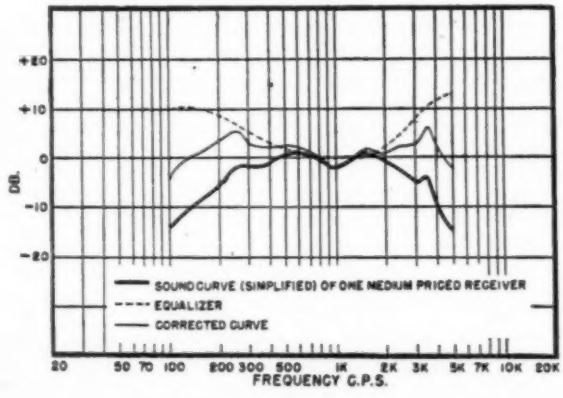


Fig. 7.

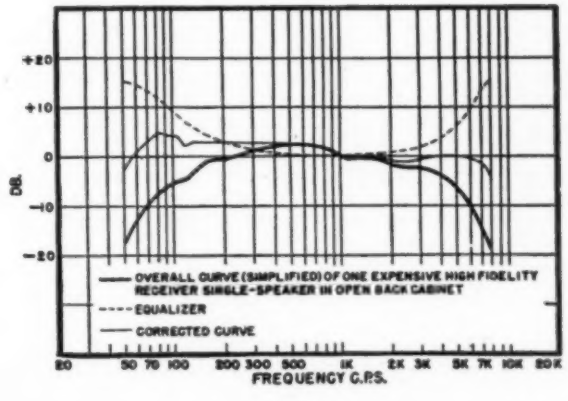


Fig. 8.

A Compact SUPERHET TUNER

Front and rear views of the home-built super. The oscillator is tuned by a National dial. Other panel controls are r.f. gain and mixer tuning.

By
JOHN F. CLEMENS
W9ERN

An easily built three tube set for the beginning ham or as a spare receiver for the more advanced amateur.

ALTHOUGH this three tube superhet is not a substitute for a large commercial communications receiver, it can provide performance comparable to many of the smaller commercial models. If one is satisfied to forego such non-essential niceties as bandswitching, broadcast band coverage, and loudspeaker output, a small receiver of this type will be found in other respects equal to or better than a low-cost commercial model.

The stability of the receiver is quite good due primarily to the fact that a large fixed capacity may be used across the oscillator coils since only the amateur bands are covered. Each amateur band is spread over approximately 80 degrees of the main tuning dial which tunes the oscillator. This amount of bandspread is ample for easy tuning and logging. Oscillator padding condensers are standard-value mica units mounted inside the tube-base coil forms. The oscillator is operated at the full plate voltage to provide sufficient oscillator power for good conversion gain in the mixer. No oscillator injection in addition to that provided by the stray coupling is provided, thereby minimizing "pulling" of the oscillator frequency as the mixer is tuned. Even with this precaution the performance of the receiver is somewhat impaired by interaction of the mixer and oscillator controls on frequencies above 14 mc. On the lower frequencies the effect is negligible.

Images are practically non-existent on the 80 and 40 meter bands and much attenuated on the higher frequency bands. The high signal/image ratio is obtained because the separately-tuned mixer is tuned exactly to resonance rather than somewhere near resonance as is usually the case in the general coverage receiver. Also, the *L/C* ratio may be made optimum for high gain and selectivity since only a narrow frequency range need be covered. The triode plate detector, recognized as the quietest of tube mixers, has quite low input conductance enabling a high effective *"Q"* to be maintained in the input circuit. Capacity coupling of the antenna to the mixer grid may be criticized because of the resulting loading effect on the mixer grid circuit, but if a small capacity is used this type of coupling will give better results than others when short antennas are used. An auto antenna has been used with this receiver with excellent results operating from the car with a 67½ volt battery for "B" supply.

The entire receiver employs a 12AT7 dual triode as mixer-oscillator, a 6AK5 as an i.f. amplifier, and a second 12AT7

Winding data for coils covering the 80, 40, 20, and 10 meter bands.

Band	80	40	20	10
C_9	330 μμfd.	200 μμfd.	100 μμfd.	100 μμfd.
L_1	12½ t. No. 26. Jumper from 5 to 7. Cathode tap (pin 8) 4 t. from gnd.	8½ t. No. 26. Cathode tap (pin 8) 4 t. from gnd. Jumper from 7 to 8.	5½ t. No. 26. Cathode tap (pin 8) 2 t. above gnd. Bandspread tap (pin 7) 1½ t. above gnd.	3½ t. No. 26. Cathode tap (pin 8) 1½ t. above gnd. Bandspread tap 1 t. above gnd.
L_2	30 t. No. 26	17 t. No. 26.	9 t. No. 26.	5 t. No. 26.

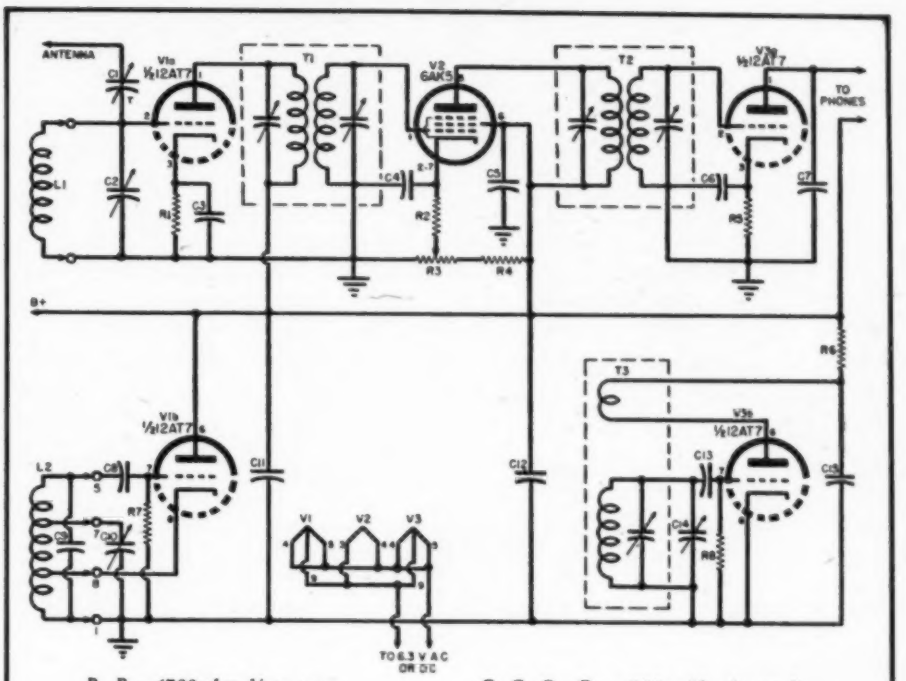
All coils ½" long, wound on octal GT tube bases, 1⅜" dia.

as second detector and beat frequency oscillator. The 12AT7 is a natural selection for its role because of its high gain and good high frequency performance, separate cathode connections and center-tapped heater permitting operation from a six volt filament supply.

The 6AK5 intermediate frequency stage gives a great deal of gain at 455 kc. If desired, a small amount of grid-to-plate capacity consisting of short lengths of wire connected to the grid and plate connections and twisted together may be added. If this capacity is adjusted until the i.f. amplifier is just on the verge of oscillation when the gain control is fully advanced, the regeneration obtained will greatly increase the selectivity and give single-signal reception similar to that obtained with a crystal filter. An "r.f." (actually an i.f.) gain control is provided and is to be preferred to other methods of control since the note of a c.w. station is unaffected by a change in the setting and a very wide range of control is obtained. The receiver is, therefore, suitable for monitoring one's own transmitter. The receiver gain is such that there is no necessity for operating at full gain all the time and most signals will give greater-than-comfortable headphone volume.

Following the i.f. is the second (plate) detector. This circuit has the advantage of providing amplification as well as detection without the resistive loading of the i.f. transformer secondary which occurs when a diode detector is used. Due to the lack of loading an "input" type of transformer may be used to drive the second detector without loss of gain and with an increase in selectivity over the usual closely-coupled "output" type of transformer.

The second half of the 12AT7 is the beat frequency oscillator. The knob protruding from one side of the receiver in the photograph is used to control the b.f.o. pitch. One of the rotor plates is slightly bent so that the condenser is shorted when fully meshed so that the b.f.o. may be turned off for the reception of phone signals. Although standard b.f.o. transformers are available, in this unit a standard i.f. transformer was modified to suit the purpose. Roughly two-thirds of the turns of one of the windings are removed and the trimmer condenser disconnected from this winding. In most transformers the windings are so phased that oscillation will occur if the usual color code is observed in connecting the leads from the transformer but if the b.f.o. does not oscillate it will be necessary to reverse the connections to the modified winding. An inch or so of hookup wire from the mixer grid to the vicinity of the b.f.o. pitch control will provide b.f.o. voltage injection of proper strength. This coupling should be adjusted by trial since too weak a b.f.o. signal will not give a loud audio beat on a strong signal while too strong a b.f.o. signal will drown weak stations in "hiss."



R_1, R_5—4700 ohm, ½ w. res.
R_2—330 ohm, ½ w. res.
R_3—25,000 ohm pot.
R_4, R_6—100,000 ohm, ½ w. res.
R_5—15,000 ohm, ½ w. res.
R_7—27,000 ohm, ½ w. res.
C_1—3-30 μμfd. mica trimmer
C_2, C_{10}—140 μμfd. APC midget var. cond.
C_3, C_9, C_{11}, C_{12}—.004 μμfd. mica cond.
C_4—.1 μfd., 100 v. cond.
C_6—25 μfd., 25 v. elec. cond.
C_7, C_8, C_{13}—240 μμfd. mica cond.
C_9—See coil table
C_{15}—20 μfd., 200 v. elec. cond.
C_{14}—15 μμfd. APC midget var. cond.
T_1, T_2—455 kc. i.f. input trans.
T_3—455 kc. b.f.o. trans. (See text)

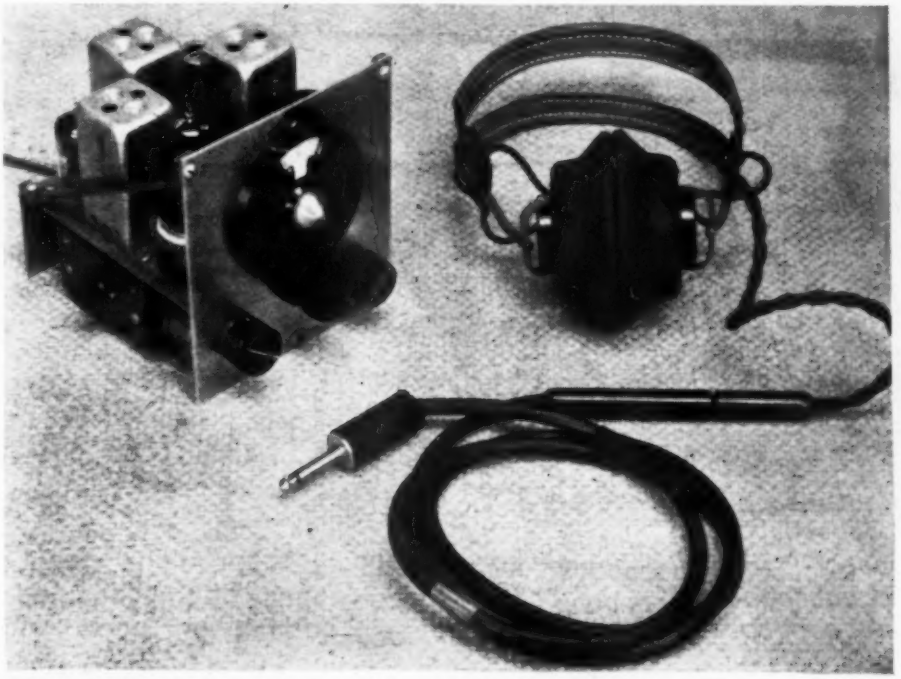
Circuit diagram of the compact three-tube communications receiver.

The receiver is constructed on a simple chassis approximately 4¾ inches square. Small braces from the rear of the chassis to the upper corners of the panel prevent "hinge" flexing of the panel and make the assembly quite stable. Of course, it is especially important that those components associated with the high frequency oscillator be mechanically rigid if the receiver is to be electrically stable.

All coils are wound on bakelite bases from old GT octal tubes. C_9, the oscillator padding condenser, is different for each band and is therefore mounted inside the oscillator coil and changed along with it. The turns of the oscillator coil may be squeezed

(*Continued on page* 156)

Compactness of set is apparent from this comparison with a pair of headphones. The shield can directly above the b.f.o. control knob contains the b.f.o. inductor.



New Trends in RECEIVER DESIGN

Part 4. The use of capacitive reactance tubes as a means of suppressing the scratch level when playing phonograph records.

By

W. WILLIAM HENSLER

Howard W. Sams & Co., Inc.

MANY new features have been incorporated in postwar receivers for increasing the listener's enjoyment of recorded music. Among these innovations are new crystal pickups which require very little needle pressure, resulting in longer record life; several new magnetic pickups having an extended frequency range for better fidelity; special "knee action" type needles to reduce the output caused by vertical movement; and the increased production of Vinylite records making more selections available on these premium records. Many of the new record changers feature a fast, quiet change cycle with automatic shut-off after playing the last record. The use of semi-permanent needles in these changers, good for several thousand plays, has practically eliminated the need of needle changing which further lessens the task of playing recorded music. Even with all these features one thing still seemed to be lacking. This was a means of eliminating the scratch caused by slight imperfections in the records and the roughness which develops as the records become worn. A true high-fidelity amplifier will reproduce the scratch as well as the recorded music. Many enthusiasts of real high-fidelity music have trained themselves to accept a certain amount of scratch without objection in exchange for the added listening pleasure afforded by the extended range of reproduction. To others, however, this scratch or hiss is not only objectionable but is highly irritating to such an extent that the "highs" must be suppressed to reduce the scratch level. A device was needed to suppress the scratch level when no high frequencies were present but would quickly "open up" and allow the higher frequencies to pass when required. Although the scratch would also be passed as the device "opened up," it would be "masked" to a certain extent by the high frequencies. Such a device would be an effective scratch eliminator and would allow the critical listener to enjoy high-fidelity reproduction with a minimum of scratch. Two such scratch eliminators, as employed by *Bendix Radio* and the *Philco Corporation*, are described in this article.

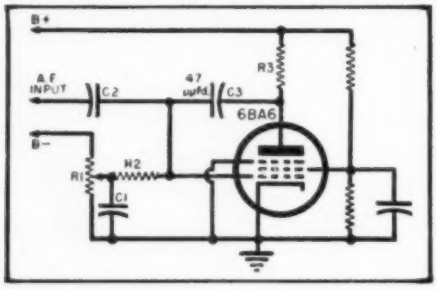
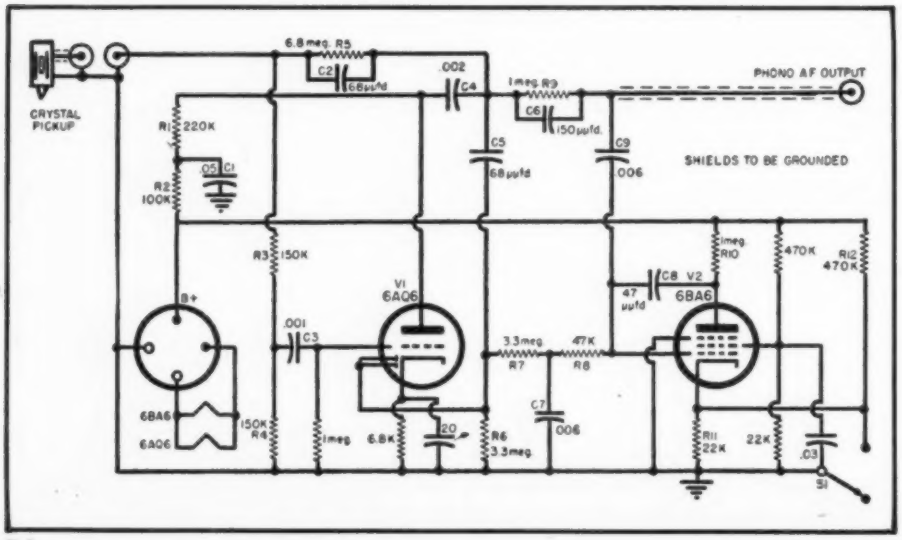


Fig. 1. A schematic of a stage in which the "Miller Effect" is achieved by means of a tube having pure resistance as a plate load.

The speed with which the scratch eliminator must respond eliminates the possibility of using mechanical means for varying the capacity to shunt the signal and as a result a capacitive reactance tube is usually employed. The rapidity with which the effective capacity of this tube can be varied makes it very suitable for this application. A schematic of the scratch eliminator used in the *Bendix* Models 1524 and 1525 is given in Fig. 2.

Tube types 6AQ6 and 6BA6 are employed. The 6AQ6 is used as an audio amplifier, its diodes being used to develop the bias voltage for the reactance tube. The 6BA6 is connected as a capacitive reactance tube. An audio signal from the pickup crystal is impressed across the voltage divider network, R_3 and R_4. A part of this signal is coupled to the grid of the audio amplifier by C_3. The signal is then amplified and coupled to the output jack through C_4 and the tone compensation network composed of R_9 and C_6. It may be seen that the circuit thus far outlined is a conventional audio amplifier stage and, with the exception of the tone compensation network in series with the output, no frequency discrimination will be accomplished. To complete the scratch eliminator, the following components are added; a feedback network consisting of a 68 $\mu\mu$fd. condenser (C_2) and a 6.8 megohm resistor (R_5) coupled from the output of the audio amplifier back to the input to provide a certain amount of degeneration for the high scratch frequencies; and, a 68 $\mu\mu$fd. condenser (C_5) coupling the signal back to the diodes, where it is rectified. Due to the low capacity of C_5, only the high frequency signals will be coupled to the diodes since the reactance of C_5 will be high for any low frequencies. The 6AQ6 is self-biased with approximately two volts on its cathode. Since the diode load resistor (R_6) returns to ground, this two volts bias acts as a

Fig. 2. Schematic of scratch eliminator used in the Bendix Models 1524 and 1525.



source of delay voltage. Thus, when the frequency is high enough, C_5, due to its low reactance, will couple enough signal to the diodes to overcome the delay voltage. It is also interesting to note that, during low level passages, the amplitude is too low to overcome the delay bias and no rectification takes place, even in the presence of high frequency signals. This is normal operation since the passing of the higher frequencies would also allow the scratch to be passed. Since the recorded signal is at a low level, the scratch would actually mask the signal, and the reproduction would be lost in the scratch. This operation would have the effect of an intermittent hiss and would be very objectionable. The rectified diode current flows "down" through the diode load resistor (R_6) giving a negative polarity at the top. This voltage is then filtered by the RC network R_7 and C_7. The voltage across the condenser C_7 is applied to the grid of the reactance tube and controls the transconductance of the tube. It is well to point out that the charge path for C_7 is through the diodes and R_7 while its discharge path is through R_6 and R_7. The resistance of the diodes can be disregarded since it is so low compared to the 3.3 megohm resistor (R_7). Resistor R_6 is equal in value to R_7 making the discharge time of C_7 twice as long as the charge time. Although this slower recovery time would seem very objectionable, the discharge path of C_7 is found to have a time constant of approximately .4 second. This is quite fast and only on badly worn records is there a noticeable hiss following the high frequency notes. As stated previously, the voltage across condenser C_7 is impressed on the grid of the reactance tube. The audio signal is also coupled to the same grid through condenser C_9. The purpose of resistor R_8 is to isolate the audio signal from C_7 which has enough capacity to shunt or attenuate the higher frequencies of the audio signal. In order to understand the operation of the complete circuit, a thorough knowledge of the theory for this particular type reactance tube is required. Therefore, a review of this theory follows.

The Miller Effect

Since both the "scratch eliminator" circuits described in this article use capacitive reactance tubes, only those types will be discussed. In more elaborate units inductive reactance tubes or a combination of both types may also be used. Although the stage used to vary the capacity, which shunts the audio signal, has heretofore been referred to as a capacitive reactance tube, actually the "Miller Effect" of a tube having a pure resistance as a plate load is employed. A schematic of such a stage is given in Fig. 1.

The input impedance of a tube having any plate load varies as the transconductance of the tube is changed. This effect is known as the "Miller Effect." If a pure resistance is used as the plate load, the input impedance will be purely capacitive. If a reactive component is used as a plate load, the input impedance will contain a resistive component. As can be seen in Fig. 1, the resistor R_3 constitutes a pure resistive load and results in a capacitive impedance at the input grid.

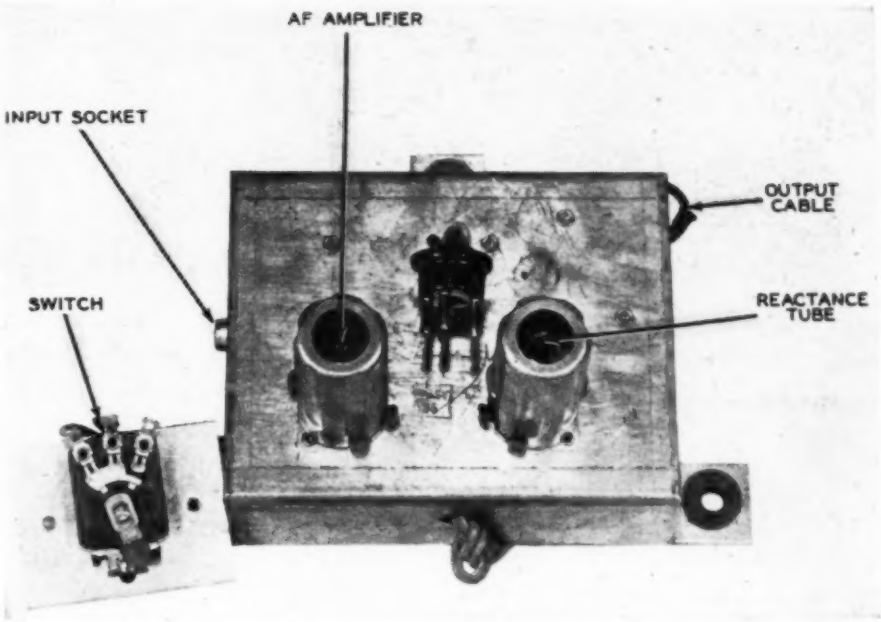


Fig. 3. Bendix scratch eliminator unit, constructed on a separate chassis.

The manner in which the input impedance can be changed by varying the transconductance of the tube can be more clearly understood by considering the charges existing on the tube elements. The charge on any condenser is expressed by the formula $Q = CE$ where C equals the capacity and E equals the voltage applied on the the opposite plates of the condenser. The charge on the grid of a tube, due to the grid-cathode capacity, may be found by multiplying the signal voltage by the grid-to-cathode capacity. Note that this charge will change according to the amplitude of the input signal, but it is not dependent on the transconductance of the tube.

The charge existing between the grid and plate will vary as the gain of the tube is changed. This can be seen by calculating the output voltage on the plate. The output voltage is found by multiplying the signal voltage by the gain of the tube; $E_{out} = E_{signal} \times M$ where M equals the gain of the stage. Since we are calculating the voltage between the grid and plate and the grid voltage is 180 degrees out of phase with the plate voltage, the potential difference must be found by the quantity: $E_{signal} \times (M+1)$. Thus, the formula for the charge on the grid due to grid-to-plate capacitance is: $Q_{gp} = E_{sig.} \times (M+1) \times C_{gp}$. Since the charge on the grid, due to the grid-to-cathode capacity, is not dependent on the gain of the tube it can be added to the effective grid-to-plate capacitance. Then the entire input capacity can be calculated by the formula: $C_{in} = C_{gk} + C_{gp} \times (M+1)$. Although the input capacity will be increased many times due to the "Miller Effect," it is still low due to the low grid to plate capacity of the 6BA6 tube and in fact, it is much too low to be useful at audio frequencies. Referring again to Fig. 1, it can be seen that a 47 $\mu\mu$fd. condenser (C_2) has been added between the plate and grid to materially increase the grid-to-plate capacity.

Resistor R_1 in Fig. 1 is shown as a variable control so that a varying bias may be applied to the tube. This bias compares to the voltage developed by the current flow in the diodes across R_6 in Fig. 2. By varying the setting of resistor R_1, the gain of the stage may be controlled. As the arm of the control is advanced the gain is decreased and reversing the motion increases the gain. Let us assume that the arm is moved up enough to apply cut-off bias to the tube. By referring to the formula: $C_{in} = C_{gk} + C_{gp} \times (M+1)$, we find that the input capacity will be the sum of C_{gk} and C_{gp} only since M (gain) equals zero. However, if the arm were set to the point where a gain of 100 could be realized, the input capacity would be approximately 5750 $\mu\mu$fd. The grid-to-plate capacity in this calculation is 47 $\mu\mu$fd. because of the addition of C_2 between the grid and plate. This input capacity is large enough to shunt the higher audio frequencies and the effective capacity of the stage can be controlled.

Referring again to Fig. 2, the operation of the scratch eliminator can be summed up as follows. During the low level passages or during the absence of high frequencies, there is insufficient voltage coupled to the diodes to overcome the delay voltage and there is no rectification. Since there is no current flow in resistor R_6 the gain of the reactance tube will remain at maximum. This results in maximum

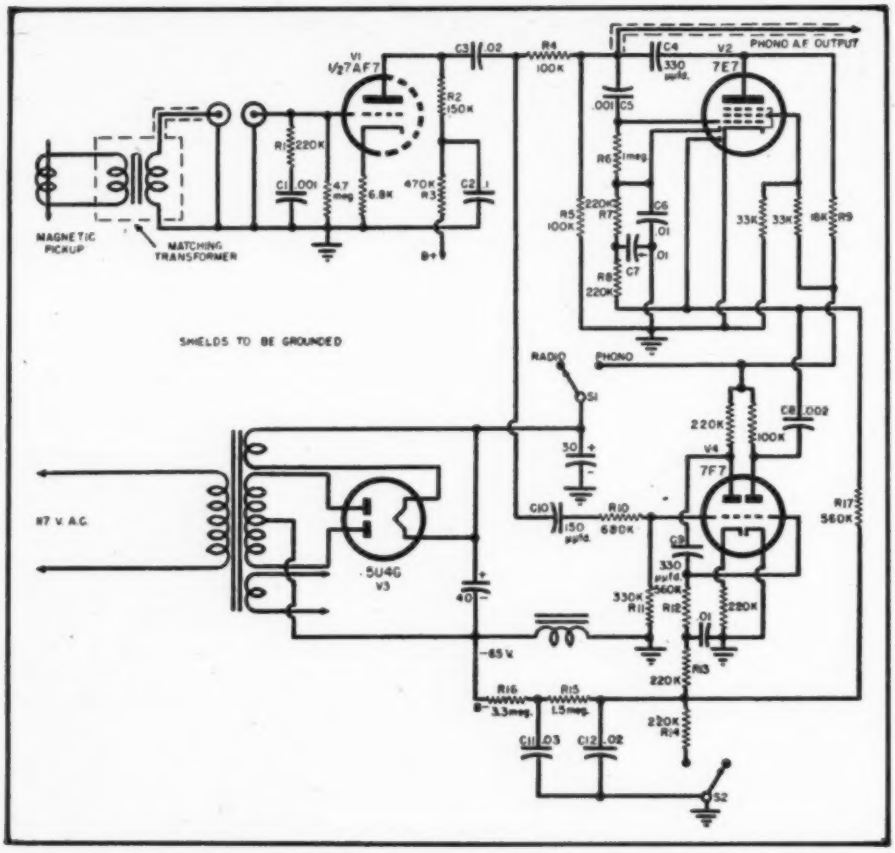


Fig. 4. The scratch eliminator as used in the Philco Model 48-1270 unit.

input capacity and a shunting of the audio signal. If, however, there is sufficient signal to overcome the delay voltage, rectification will take place. The current flow in R_6 will decrease the gain in the reactance tube and the input capacity will decrease. This decrease will allow the higher frequencies to pass. Although this action has been described as a chain of events, it should be borne in mind that this shunting effect is constantly changing resulting in good reproduction of the recorded music with a minimum of surface noise.

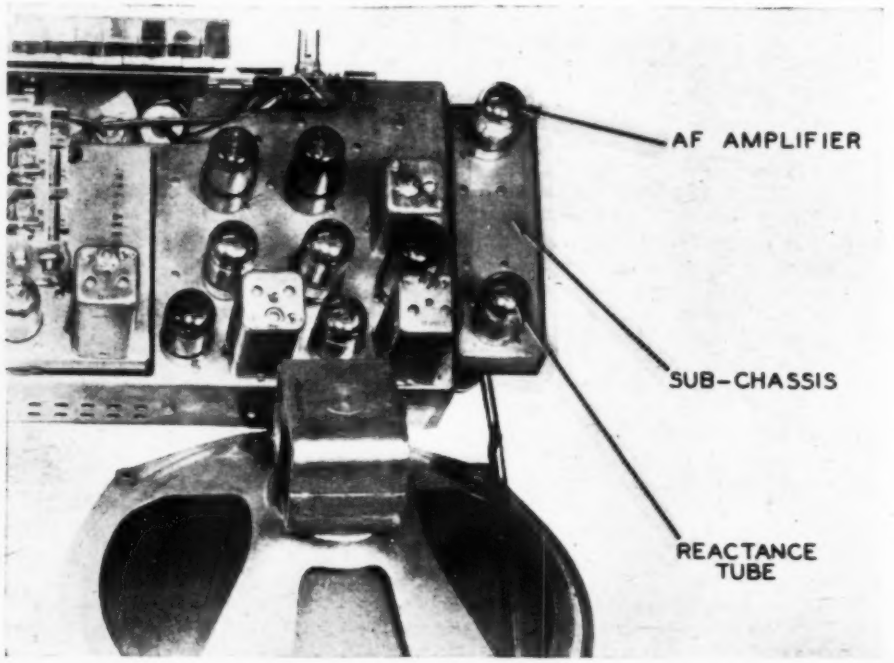
The eliminator unit shown in Fig. 3 is constructed on a separate chassis. The phonograph pickup cable plugs into the input socket and the output of the unit plugs into the phono socket of the receiver or amplifier. Although *Bendix* builds this unit into several of their models, this unit can be installed in some of their earlier models with a minimum of changes. The switch shown in the photograph and as S_2 in Fig. 2 is for the purpose of disabling the unit. With the switch open, current flowing through the bleeder network R_{12} and R_{11} biases the reactance tube to cut-off and there is a minimum of shunting on the audio signal.

A schematic of the scratch eliminator used in the *Philco* Model 48-1270 is shown in Fig. 4. A portion of the power supply is illustrated to show how the negative bias is obtained for disabling the circuit when not being used. A portion of this voltage is also used for fixed bias when the circuit is operating. This particular receiver uses a magnetic pickup which is coupled to an impedance matching transformer. The output of this transformer is fed to a triode which is one-half of a 7AF7 tube. A bass boost network composed of R_1 and C_1 has been connected in the grid circuit of this tube. The output of this stage is coupled by condenser C_2 to a voltage divider composed of R_4 and R_5. The output is taken from the junction of these two resistors. The audio signal is also coupled to the grid of the reactance tube from this point by condenser C_3. The total signal across the voltage divider network is coupled to the 7F7 amplifier stages by condenser C_{10}. The capacity of C_{10} is low (150 $\mu\mu$fd.) and offers a high impedance to the low audio frequencies. The higher frequencies are coupled to the voltage divider network, R_{10} and R_{11}, from which only about a third of the signal is fed to the grid. The output of this stage is then coupled to the next stage, again through a small capacity to attenuate the lower frequencies. This stage has fixed bias which is taken from the negative return of the power supply. This voltage is well filtered by the *RC* filter network R_{16}, C_{11}, R_{15} and C_{12}. With the switch S_2 closed, which is the "on" position, approximately three volts of minus polarity is applied to the grid. This bias voltage is also fed to the reactance tube through R_{17}. A type 7E7 tube is employed as a reactance tube. One of the diodes is used to rectify the audio signal coupled from the plate of the last section of the 7F7 by C_8. The negative three volts is also applied to the diode as a delay bias to prevent rectification during low level passages. The current flow of this diode is "down" through R_{17} which increases the bias on the reactance tube. This bias voltage is filtered by the *RC* network R_9, C_7, R_7 and C_6. A 330 $\mu\mu$fd. condenser (C_4) has been added from the plate circuit to the grid circuit of the reactance tube to increase the grid-to-plate capacity of the tube which is very low when connected as a pentode. As the gain of the 7E7 pentode section is varied the input capacity of the tube will change. This varying capacity shunts the audio signal and filters the scratch.

The operation of this circuit is as

(*Continued on page* 102)

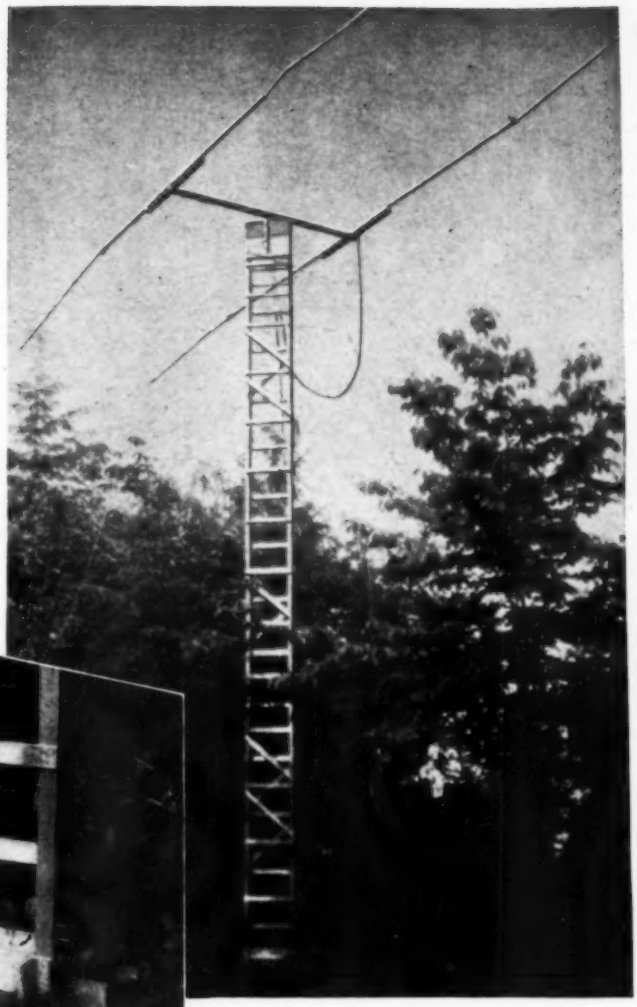
Fig. 5. Schematic of the scratch eliminator used by Philco in the Model 48-1270.

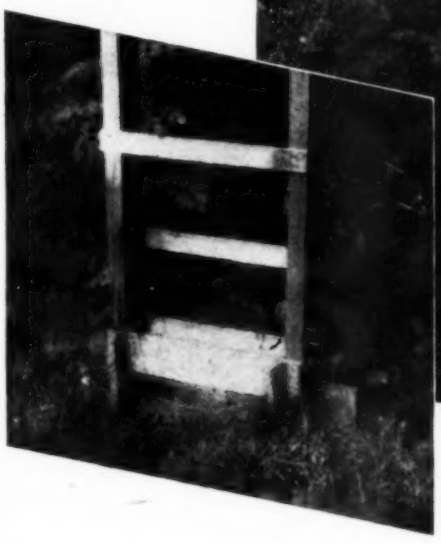


An Inexpensive "LADDER" TYPE MAST

A low-cost support capable of carrying a 20 meter rotary beam. Total cost of parts amounted to $7.50 or about 30 cents per foot.

By
NICHOLAS LEFOR, W2BIQ





Two views of the completed antenna mast. Ladder-type steps provide easy access to top of unit for mounting and adjustments. Details for bracing the base are shown in closeup of mast in photograph at left.

AFTER it was decided that a rotary beam was a "must" in our present location, the next step was to select a mast, pole, or tower to support the beam.

Upon consulting available handbooks, and back issues of all the popular amateur magazines, no structure could be found that would suit our particular purse or purpose.

While a telephone pole looked like the ideal solution, an asking price of approximately two and one-half dollars per foot in our vicinity dictated a bowing out in favor of the purse. "A" frames and "T" masts, standards in mast construction, not only wouldn't support the beam, but for the length required (approximately 30 feet) the price appeared exorbitant for its purpose.

The purpose was to support a beam, but must also permit climbing the structure, mounting the 20 meter beam, and making necessary adjustments.

It should approximate a half wave height at the operating frequency, and should be simple to construct and erect.

To accomplish the foregoing purposes a ladder type structure was decided upon and this decision was followed by a visit to the local lumber yard.

Since 24 foot 2 x 4's are now available, 2 lengths of 24 foot 2 x 4's, 100 feet of ¾ x 1½ firring strip and 3 pounds of 1½" long headed nails were purchased. Total price of the material amounted to $7.50 or approximately thirty cents per foot. Several of our requirements had now been met, namely an approximate height of a half wavelength on 20 meters, and sufficient change from a ten dollar bill to purchase appeasement for the "XYL" when she sees the mast on the front lawn.

With the aid of only a hammer and saw, the structure as shown in the diagram was constructed in the matter of several hours. The two 2 x 4's were laid on edge and parallel 18" from outside to outside. About 50 pieces of firring strip, 18", were cut and nailed across the 2 x 4's every 18 inches.

This was repeated on the opposite side of the 2 x 4's but were displaced 9" as indicated in the diagram. Cross braces were nailed and trimmed in several places as indicated in the photographs to eliminate possible side swaying of the 2 x 4's. In addition several scrap pieces of 1" x 6" boards were nailed to the top of the ladder. This was done to accommodate the bearing pipe for the beam.

The location for the ladder mast was selected and a footing constructed by driving several 2½ foot pieces of firring strip into the ground about 1½ feet deep and 2 feet apart. To this were nailed several more pieces of scrap wood and a base of 4" wide by 2 feet long wood strip.

The foot of the ladder mast was placed at this footing, and with the ladder mast lying on the ground, 3 guy wires, 120 degrees apart were attached at the top, and strung to their respective tie points, allowing sufficient slack so that the mast could be raised to a vertical position without the guy wires snagging.

Incidentally at this point, the length of guy wires required may be figured out quite accurately if one dusts off his high school trig books.

While the mast was moved around during all these operations by the author, the point was now reached where the aid of several neighbors had to be enlisted to raise the mast to a vertical position.

With the aid of the footing already described, it was a simple matter of heave and the mast found itself, as the author thought anyway, pointing majestically skyward.

With the mast in this position the three guy wires were fastened evenly

(*Continued on page* 160)

Mac's RADIO SERVICE SHOP

By JOHN T. FRYE

BARNEY PLAYS "TWENTY QUESTIONS"

THE November morning was overcast, and there was a cold damp wind blowing the scattered leaves about the streets; but this had no effect on Barney's cheery whistling as he stepped into Mac's Radio Service Shop and found Mac already at work at the bench.

"The top of the morning to you, Boss," he greeted as he hung up his jacket and slipped into a shop coat. "What great electronic p r o b l e m s await my solving this morning?"

"Well, if it is not asking too much of you, Marconi the Younger, you might put a new output transformer in that set on the other end of the bench."

Barney, still whistling, went to work removing the old output transformer from the speaker. Mac, who was working on a wire-recorder-receiver combination, switched the output of the signal generator into the signal tracer so that the 400 cycle note came clear and strong through the speaker; and then he said to Barney, who was getting in some very hot licks on *The Whistler and His Dog*, "Would you mind muzzling that dog for a couple of minutes while I get this audio oscillator on the wire?"

Barney remained mute while Mac put about three minutes of the 400 cycle note on the wire through the microphone, but the instant the "rewind" switch was snapped, he burst forth with, "Why are you doing that?"

"The complaint on this outfit is that music does not sound good on it, although voice seems to be natural. I feel confident the trouble is caused by 'wowing' as a result of uneven pulling of the wire. The quickest way to detect a condition like that is to listen to a sustained note of unvarying pitch that has been recorded. If the speed of the wire changes this will show up as a change in frequency of the recorded note. Catch?"

"I catch," Barney said; "but why doesn't it affect the voice recording?"

"It does, but because the voice is continually changing frequency itself, it is harder to detect this kind of distortion with speech on the wire."

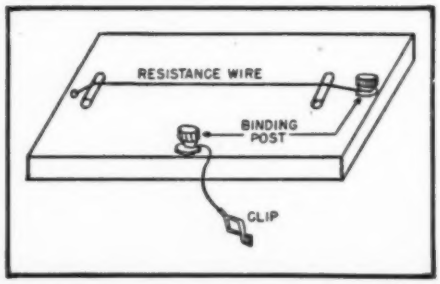
"It seems to me that if the wire changed its speed during the playback exactly as it had during the recording, you would not notice anything wrong."

Mac's face wrinkled into the pleased grin that a shrewd observation on the part of his apprentice always evoked. "You are exactly right; but since this change in speed is caused—I think—by slippage in the drive mechanism, it would be a very rare coincidence if those changes *were* in step."

The recorder was switched to "Play Wire," and the audio note came through with a rhythmic rise and fall of frequency that clearly indicated the inspiration for that term "wowing."

"Now that you are sure you guessed right, what are you going to do about it?" Barney wanted to know.

Fig. 1.



Without replying, Mac loosened a jam nut on the back of the frame of the wire-transporting motor and carefully adjusted the screw that this freed. As he did so, the note improved, although there was still some deviation. Once more he recorded the 400 cycle note, and this time when it was played back, it came through as clearly and as unvarying as it had come from the speaker.

"That adjustment, which is a ticklish one, regulates the 'motor torque,'" Mac explained. "If it is a little too loose, there is some slippage, and the wire is pulled unevenly, both on 'Recording' and on 'Playback.'"

"What if it is too tight?"

"When you change from 'Rewind' to 'Playback,' the reversal is so abrupt that the wire is broken. Usually, though, the change due to wear is toward the 'too loose' direction, and about a quarter of a turn of that adjusting screw in a counter-clockwise direction will take the 'wow' out."

While Mac was putting the wire-transporting mechanism back in the recorder case, Barney installed a new "universal" output transformer on the speaker frame and connected the primary winding. Then he looked into the service manual to see what the impedance of the voice-coil was so that the proper taps of the secondary could be used, but the information was not given.

"Hey, Mac, how am I going to match the transformer to the voice-coil impedance when I don't know what the coil impedance is?" he asked.

"We use the one-string fiddle for that," Mac told him gravely.

"The *what*?"

"The one-string fiddle," Mac repeated as he opened a cabinet and took out a narrow piece of wood about a foot and a half long with a slender wire stretched along the length of it (See Fig. 1). One end of the bare wire went beneath a binding post, and there was another binding post at one side of the little board with a flexible lead terminating in a tiny battery clip attached to it.

"That thing looks as though it would suck eggs," Barney muttered. "How can it help in finding the voice-coil impedance?"

"Just watch, impatient little man, and you will see," Mac said as he switched on the v.t.v.m. and brought a couple of leads from the audio output of the signal generator and clipped them across the volume control.

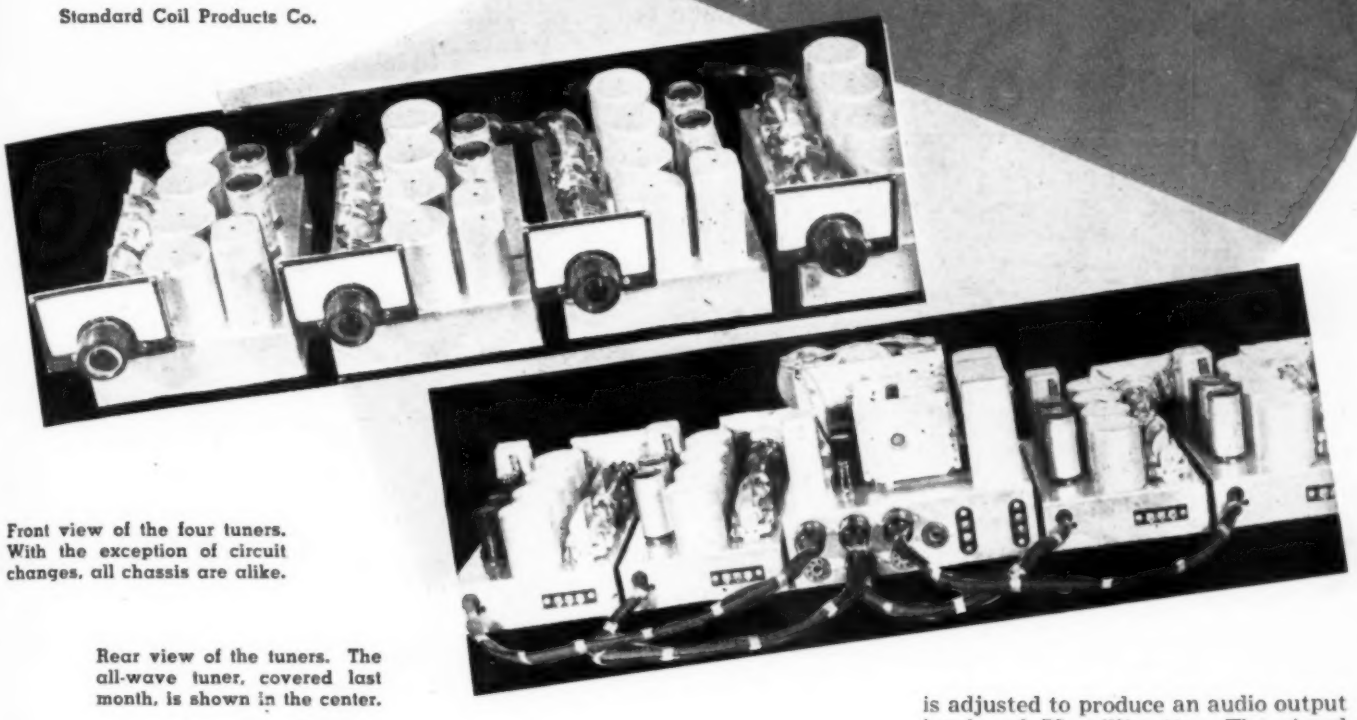
"That wire is resistance wire, and there is about twenty ohms' worth of it there. I am placing this simple rheostat—for that is what it really is—and the voice-coil in series across any two convenient taps of the output transformer, like this": and he sketched Fig. 2 on the blackboard at the end of the bench.

"Now I attach the ground lead of the vacuum-tube voltmeter to point *B* and check the audio voltages that

(*Continued on page* 161)

Build Your Own COMMUNICATIONS RECEIVER

By
J. T. GOODE
Standard Coil Products Co.



Front view of the four tuners. With the exception of circuit changes, all chassis are alike.

Rear view of the tuners. The all-wave tuner, covered last month, is shown in the center.

Part 4. Complete details on the 75, 40, 20, and 10 meter r.f. tuners. They are all built on individual chassis and are identical in construction. Previously covered were power and audio assembly, the i.f. channel and all-wave tuner.

"VK3BN from W6XYZ, sorry OM but the noise level is above your signal level." How many of your DX contacts end with the above comment?

Noise can be classified into two types, noise generated in the receiver or noise picked up by the antenna. The latter type of noise can only be eliminated at the source. Noise generated in the receiver may be reduced to a minimum by adequate engineering design.

Every amplifier stage in a receiver is capable of creating noise. A high gain amplifier stage will produce more noise than a low gain stage. A pentagrid converter will produce more noise than a triode converter but the gain of the triode converter is low compared to the pentagrid stage. Any amount of regeneration will increase the noise level.

It becomes immediately apparent that if a receiver is to have a high signal-to-noise ratio (25 to 1), the gain per stage will be adjusted in favor of signal-to-noise ratio rather than maximum gain, the other requirement being that regeneration be completely eliminated.

The r.f. tuners described in this article were designed around the following specifications:

1. Adequate gain with a signal-to-noise ratio of 25 to 1.
2. Readily obtainable parts that are available at most radio stores.
3. Mechanical and electrical design such that anyone with a basic knowledge of radio can construct the tuners and be assured satisfactory operation.

The operating characteristics of a receiver are normally measured using the following procedure.

A known signal level measured in microvolts is fed into the antenna input circuit. The signal generator is modulated at a level of 30 per-cent. An output meter calibrated in milliwatts is connected in place of the loudspeaker. A reference level of 50 milliwatts is used. The volume control of the receiver is rotated to maximum output.

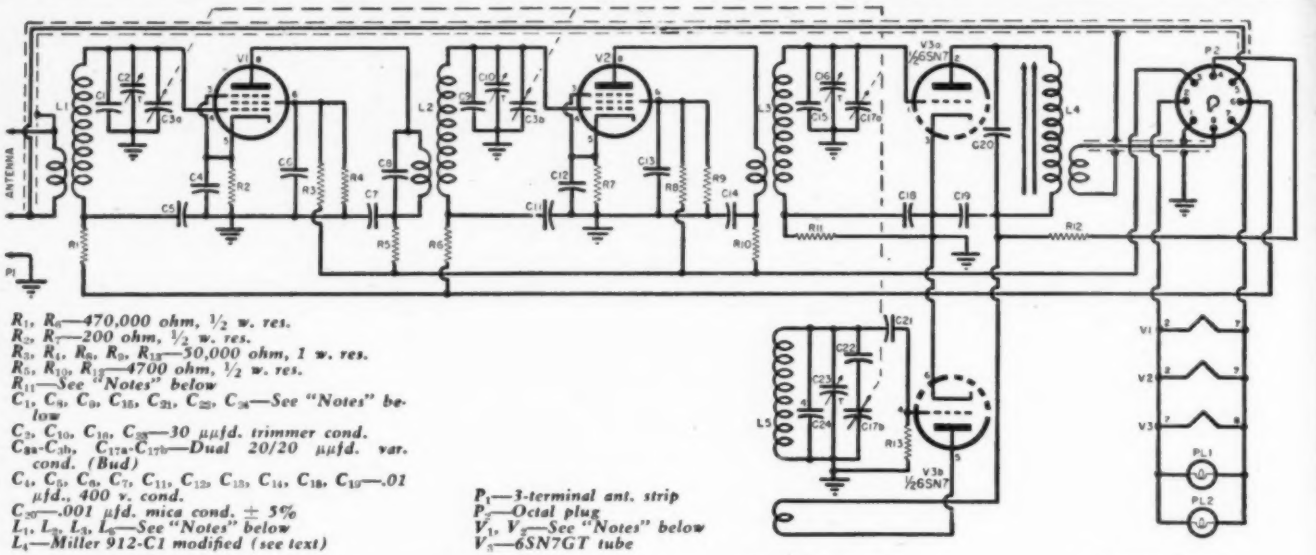
The output of the signal generator is adjusted to produce an audio output level of 50 milliwatts. The signal generator modulation is then turned off and the difference between the output levels is the signal-to-noise ratio. The microvolt level of the signal generator indicates the sensitivity of the receiver.

A signal-to-noise measurement without a sensitivity measurement is meaningless, likewise a sensitivity measurement without a signal-to-noise measurement is also meaningless.

Some communication receivers have such a poor signal-to-noise ratio that the previously outlined method of measurement cannot be used. With the antenna terminals shorted and the volume full on, the audio output will be on the order of two or three watts instead of one or two milliwatts. This is due to the noise generated in the receiver.

To make measurements on such a receiver it is necessary to reduce the audio gain control until the noise level is reduced sufficiently to make measurements.

It is common practice to consider a receiver capable of receiving a one microvolt signal as a "hot" receiver. If the signal-to-noise ratio is two-to-one or less (which is not uncommon), the fact that one microvolt can be heard does not mean that satisfactory reception is possible at a one microvolt level. Since one half of the audio output is noise it is doubtful that a



R_1, R_6—470,000 ohm, ½ w. res.
R_2, R_7—200 ohm, ½ w. res.
R_3, R_4, R_8, R_9, R_{12}—30,000 ohm, 1 w. res.
R_5, R_{10}, R_{13}—4700 ohm, ½ w. res.
R_{11}—See "Notes" below
C_1, C_6, C_9, C_{15}, C_{21}, C_{22}, C_{24}—See "Notes" below
C_2, C_{10}, C_{16}, C_{23}—30 μμfd. trimmer cond.
C_{3a}-C_{3b}, C_{17a}-C_{17b}—Dual 20/20 μμfd. var. cond. (Bud)
C_4, C_5, C_8, C_7, C_{11}, C_{12}, C_{13}, C_{14}, C_{18}, C_{19}—.01 μfd., 400 v. cond.
C_{20}—.001 μfd. mica cond. ± 5%
L_1, L_2, L_3, L_5—See "Notes" below
L_4—Miller 912-C1 modified (see text)

P_1—3-terminal ant. strip
P_2—Octal plug
V_1, V_2—See "Notes" below
V_3—6SN7GT tube

75 METER TUNER
R_{11}—25,000 ohm, ½ w. res.
C_1, C_9, C_{15}—Omit
C_6—100 μμfd. ceramic cond.
C_{21}—25 μμfd. ceramic cond.
C_{22}—.001 μfd. mica cond.
C_{24}—10 μμfd. ceramic cond.
L_1—Miller B-727-A
L_2, L_3—Miller B-727-RF
L_5—Miller B-727-C
V_1, V_2—6SK7 tube

40 METER TUNER
R_{11}—25,000 ohm, ½ w. res.
C_1, C_9, C_{15}, C_{24}—50 μμfd. ceramic cond.
C_6—10 μμfd. ceramic cond.
C_{21}—25 μμfd. ceramic cond.
C_{22}—.003 μfd. mica cond.
L_1—Miller C-727-A
L_2, L_3—Miller C-727-RF
L_5—Miller C-727-C
V_1, V_2—6SK7 tube

20 METER TUNER
R_{11}—4700 ohm, ½ w. res.
C_1, C_9, C_{15}, C_{24}—85 μμfd. ceramic cond.
C_6—Omit
C_{21}—25 μμfd. ceramic cond.
C_{22}—.01 μfd. mica cond.
L_1—Miller D-727-A
L_2, L_3—Miller D-727-RF
L_5—Miller D-727-C
V_1, V_2—6SK7 tube

10 METER TUNER
R_{11}—4700 ohm, ½ w. res.
C_1, C_9, C_{15}, C_{24}—50 μμfd. ceramic cond.
C_6—Omit
C_{21}—10 μμfd. ceramic cond.
C_{22}—Omit—connect C_{17b} direct to C_{21}
L_1—Miller E-727-A
L_2, L_3—Miller E-727-RF
L_5—Miller E-727-C
V_1, V_2—6SG7 tube (Tube socket connections must be changed from those shown in schematic—check with tube manual)

Circuit diagram of the r.f. tuners. Variations in design to cover each of the 75, 40, 20, and 10 meter bands are shown in parts list above. The output plug of each of these tuners connects to specific sockets on the all-wave receiver discussed in last month's issue. For correct arrangement, the 75 meter tuner connects to P_2, 40 meter to P_3, the 20 meter to P_4, and the 10 meter to P_5.

signal could be copied under such conditions.

By reducing the audio gain control and increasing the input so that a ten-to-one signal-to-noise ratio is obtained, the sensitivity of the receiver may be in the order of ten microvolts.

A ten-to-one signal-to-noise ratio will produce satisfactory reception but the noise level will be readily noticeable.

All measurements made on the equipment described in this article were obtained with a *Ferris* 18 C signal generator and a *General Radio* Model 583-A audio output meter. This equipment is considered satisfactory for making accurate receiver measurements.

Tuner Design

The difference in expense and effort between building just another tuner or a tuner of above average characteristics is not great. In line with the design of the rest of the receiver, the design of the r.f. tuners is such to equal or exceed operating characteristics of any receiver now on the market.

To obtain adequate sensitivity and satisfactory image rejection, two r.f. stages are used. With more than adequate gain available the gain of each stage can be reduced below normal, resulting in excellent signal-to-noise conditions and complete elimination of regeneration.

Designing in favor of signal-to-noise ratio dictated the selection of the triode converter. A separate triode is used for the oscillator. This type of design is far superior to the pentagrid converter. The stability of the oscillator is greatly improved since the two circuits are independent of each other.

The tuning range of each tuner is restricted to a particular band of frequencies. This results in practically perfect tracking.

All the coils are stock items. The i.f. line transformer is a stock item but requires modification to match the lower plate impedance of the triode converter.

Image rejection ratios decrease as the frequency is increased. At 4000 kc. one r.f. stage will produce a greater image ratio than two r.f. stages at 30,000 kc. One r.f. stage operating at 30,000 kc. may have an image ratio of only 15 to 1. In this case the receiver is capable of receiving distant stations on the image frequency and local stations cause serious interference.

If the intermediate frequency is increased the image ratio will increase. High frequency i.f. channels decrease selectivity which is undesirable in a communications receiver. The use of the double superheterodyne principle is a more satisfactory method of obtaining high intermediate frequencies without sacrificing selectivity.

When two r.f. stages are used satisfactory image rejection up to 30,000 kc. can be obtained with an intermediate frequency of 455 kc.

The tuned circuits of the r.f. amplifiers determine the image rejection of a receiver. Receiver coils are normally designed for a specific application. The important design factors are frequency coverage, coupling, "Q," and mechanical construction for stability and shielding.

The writer does not advocate that inexperienced radio enthusiasts wind their own coils for the equipment to be described. Coil design requires adequate test equipment, and "know how" which the builder may lack.

To offset the coil difficulties standard *Miller* coils are used throughout. The circuit is designed around these coils eliminating the necessity for further design by the builders. Other coil manufacturers also make coils satisfactory for this purpose.

The circuit is identical for all four tuners. Parts that differ between tuners are outlined in the circuit diagram. The chassis, parts layout, and wiring are identical in each tuner.

Condenser C_6 is used only on the 75 and 40 meter tuners. This condenser reduces the gain of this stage and is adjusted for a maximum signal-to-noise ratio. If the coupling of coil L_1 was adjustable the coupling could be reduced which would be a more satisfactory method of reducing the gain. The use of the condenser means the builder can use the standard coils as is.

The i.f. coil is a *Miller* 912-C1 modified in the following manner. The plate impedance of the triode mixer is considerably lower than that of a pentagrid converter. The *Miller* 912-C1 is designed to match the plate circuit of the pentagrid converter.

Remove the coil from the can. Cut the bottom winding out but do not dis-

turb the coil form. Remove the shunting condenser from the terminal board. The top winding is also shunted by a condenser. Remove this condenser.

Next remove 150 turns from this top winding and reconnect the lead to the terminal board. Wind five turns of number 36 or larger wire around the coil form next to the top winding and connect the leads to the bottom terminals of the terminal board.

Condenser C_{20} tunes this winding to 455 kc. and has a capacity of .001 μfd. plus or minus 5 per-cent. This condenser should be mica or ceramic.

The chassis is made of one sixteenth-inch aluminum and the corners are soldered. Steel chassis can be used. The layout provides short grid and plate leads.

The frequency determining condensers C_1, C_9, C_{15}, and C_{24} should be ceramic or silver mica. Low frequency mica condensers will not give satisfactory operation on the ten meter tuner.

The circuit diagram indicates definite pin numbers for each cable connection. These numbers correspond to the socket connection of the all-wave tuner described in the October issue of RADIO & TELEVISION NEWS.

Refer to the circuit diagram of the all-wave tuner for connections to these sockets. The wiring can be simplified by wiring P_2 first, P_3 second and so forth.

The shield is grounded at the plug end only. Cut the shield back on the switch end of the cable to a desired length. Cover the bare shield with scotch tape so there is no danger of the exposed shield making contact with some other electrical circuits.

Ground lugs should be mounted under the socket mounting screws of all tuner power sockets on the number one pin end. Solder a piece of bus bar wire from this ground lug to number one pin of each socket. The shield of the low impedance and antenna leads ground to this bus bar.

The frequency range of each tuner is as follows.

75 meter tuner—1500-4500 kc.
40 meter tuner—3750-11,000 kc.
20 meter tuner—8500-23,000 kc.
10 meter tuner—12,500-36,000 kc.

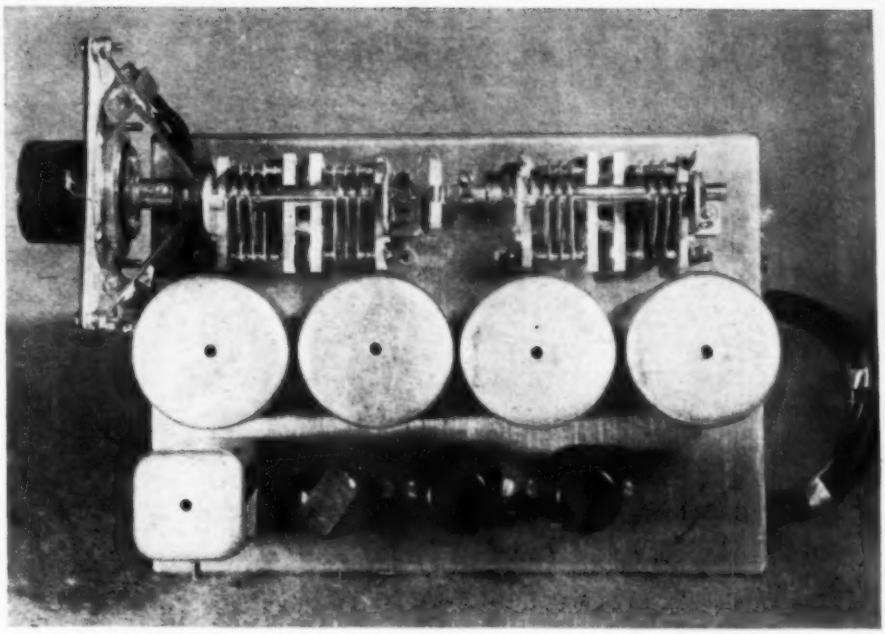
The frequency coverage of each tuner is restricted by the capacity range of the main tuning condenser. The frequency determining condensers shown in the circuit diagram are the correct value for each ham band.

Those desiring frequency coverage other than the ham bands can do so by changing the frequency determining condensers. The main tuning condenser capacity can be changed to increase or decrease bandspread on the dial.

The main tuning condenser has a capacity change of 20 μμfd. per section giving a frequency coverage for each tuner as follows.

75 meter tuner—3500-4000 kc.
40 meter tuner—6900-7350 kc.
20 meter tuner—13,950-14,600 kc.
10 meter tuner—28,000-29,850 kc.

The low frequency limit of each tuner is obtained when the shunt capacity across the secondary of the coils is 365 μμfd.



Top chassis view of one of the four tuners used in the communications receiver.

Tuning Procedure—75 Meter Tuner

Plug the power cable into power socket P_2 on the all-wave tuner and rotate the selector switch to the correct position.

Connect a signal generator to ground and the grid of the mixer tube. Tune the signal generator to 455 kc.

Set the "Selectivity Switch" on the i.f. chassis to "sharp" position.

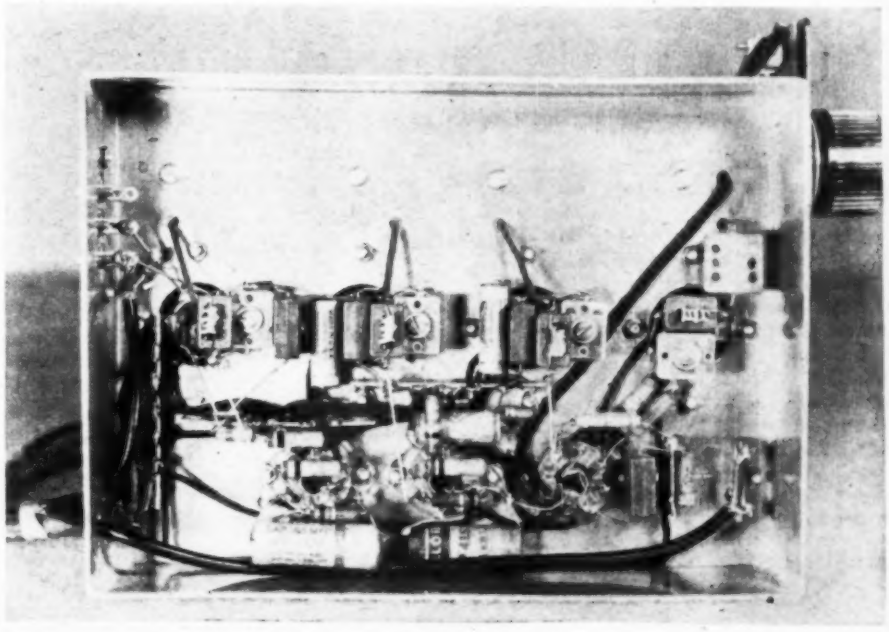
Adjust the tuning slug of the line transformer L_4 for maximum "R" meter indication. If the "R" meter reads above R8 reduce the signal generator output.

If the "R" meter indicates maximum with the slug adjustment all the way in, increase capacity C_{20} by shunting it with another 100 μμfd. condenser. If the "R" meter indicates maximum with the slug all the way out reduce the capacity of C_{20}. The tuning adjustment will appear to be broad due to the low impedance of the circuit but the slug adjustment will give a definite indication of resonance when the correct value of capacity C_{20} is determined. If a low tolerance condenser is used this juggling should not be necessary.

Next connect the signal generator to the grid of the second r.f. stage and set the frequency to 4000 kc. Rotate the main tuning condenser to minimum position. Adjust oscillator trim-

(*Continued on page* 174)

Under chassis view of one of the tuner units. All of the tuners are built on identical standard metal chassis which measure 9 by 6½ by 2 inches in size.



An A.C.-D.C. RECEIVER for AM and FM

By W. A. HARRIS and R. F. DUNN
Tube Dept., Radio Corporation of America

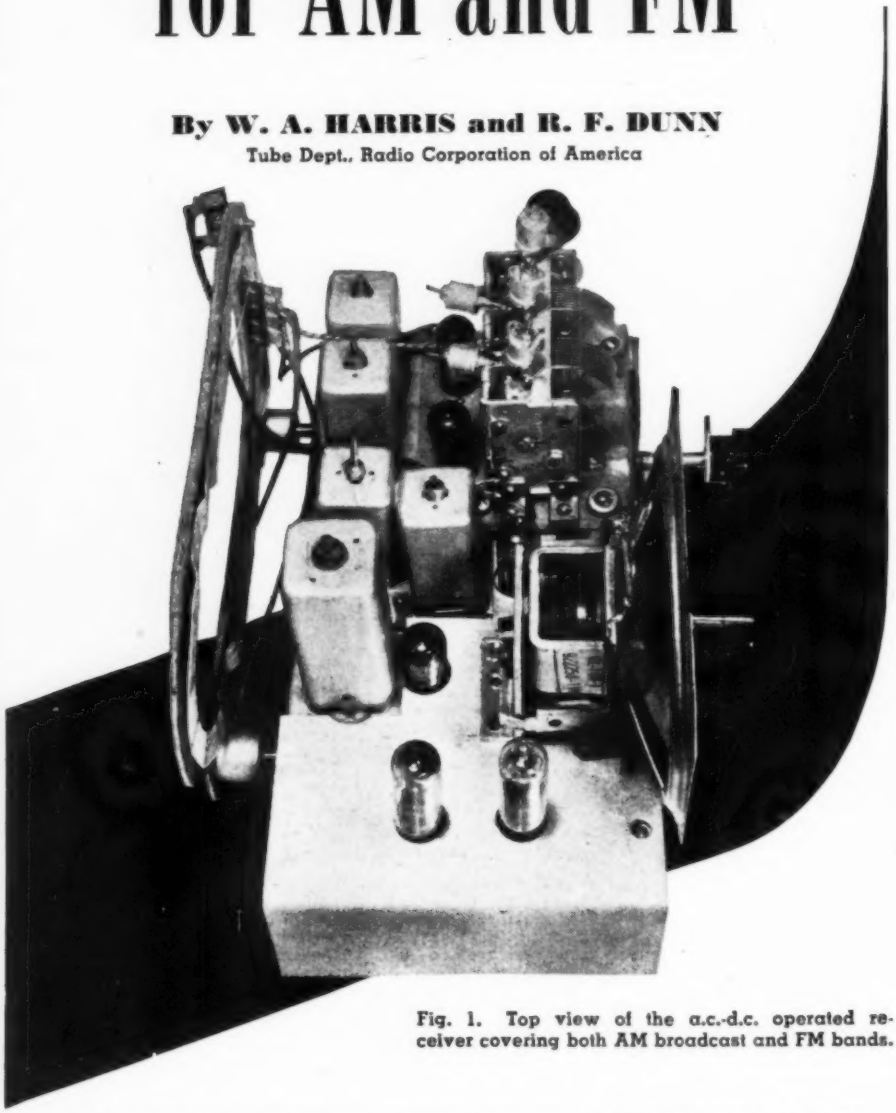


Fig. 1. Top view of the a.c.-d.c. operated receiver covering both AM broadcast and FM bands.

Construction details covering an AM-FM receiver which employs several new-type miniature tubes.

IN THE past, AM receivers for use on either a.c. or d.c. power supplies have enjoyed wide usage. For the future, there are indications that a.c.-d.c. receivers for reception of both AM and FM will have equal popularity. To investigate the possibilities of such a circuit, the authors designed and constructed an a.c.-d.c. AM-FM receiver employing seven tubes and a rectifier. The receiver uses all miniature tubes and covers the high-frequency FM band and the standard broadcast band. It afforded an opportunity to obtain information on the operation of certain new miniature tube types and to check the performance of other miniature types under conditions generally encountered by equipment designers.

The design of a receiver including an FM band does not follow the familiar pattern employed when a short-wave AM band is added to a broadcast receiver. There does not seem to be any practical way to just add FM to an AM receiver. Instead, the problem involves designing an FM receiver and then determining the most practical way to add one or more AM bands. The FM requirements determine the number and types of tubes to be used, the tuning mechanism, and, to a considerable extent, the arrangement of parts.

A list of the tubes used in the receiver described in this article, along with their functions in both the AM and FM bands is given in Table 1. This tube complement fulfills the major a.c.-d.c. requirement in that the sum of the tube heater voltages is equal to the nominal line voltage. Choice of the 35W4 rectifier permits the use of a six-volt panel lamp connected to the rectifier heater tap and thus provides a saving in power consumption and cost, in comparison with the use of a 117-volt lamp or a lamp operated through a series resistor. Low power consumption is an important feature in a.c.-d.c. receivers, particularly when small cabinets are used.

Type 12AL5, a high-perveance diode identical with type 6AL5 except for heater voltage and current, is used for the FM detector. In FM service, types 6AL5 and 12AL5 are recommended for the ratio-detector type of circuit because of their high perveance and good balance between sections.[1] For the r.f. and i.f. amplifier stages type 6BJ6, a remote cut-off pentode with a six-volt 150-milliampere heater, is used. Although similar to type 6BA6 in many respects, the 6BJ6 has a higher input resistance and a lower input capacitance than the 6BA6. In addition, the difference in basing results in lower feedback admittance for the 6BJ6 at high frequencies. The other tubes listed in Table 1 are well-known miniature types and their functions are identified in the table.

Layout Considerations

The receiver circuit diagram is shown in Fig. 2; a sketch of the chassis layout viewed from the bottom is given in Fig. 4; and a photograph of the receiver, top view, is given in Fig. 1. The r.f. amplifier, converter, gang condenser, and switch are mounted as a sub-assembly. This method of mounting permits the use of rubber gaskets to cushion these components against vibration. When cushioning is used, the sub-assembly is connected to the main cadmium-plated chassis by flexible metal straps. As can be seen from the sketch in Fig. 5, the r.f. sub-assembly is designed to keep all important lead lengths as short as possible. The tuning condenser has five sections, three for FM and two for AM, and is mounted on top of the sub-assembly. The FM coils are rather small, $\frac{3}{16}$ of an inch in diameter and $\frac{1}{4}$ of an inch in length, and are placed just below the tuning condenser. Blocking condensers are used for d.c. isolation on all circuits so that the coils can be connected directly to the sub-assembly at the points where the straps are connected. The r.f. and converter tube sockets are mounted just behind the tuning condenser. A two-section switch is used, with a third stator section added to provide tie points. The broadcast-band oscillator coil and a 455-kilocycle wavetrap are also mounted on the sub-chassis.

The layout of the i.f. stages also is planned so that short grid and plate connections can be used. The transformer location differs from usu-

[1] Seeley, S. W. and Avins, J.: "The Ratio Detector," RCA Review, Vol. VIII, No. 2, p. 201, June, 1947.

al layout practices in that an AM transformer winding is next to the grid of the first i.f. amplifier. This arrangement, dictated by layout considerations and available components, increases the capacitance between grid and cathode of the first i.f. stage in the FM band. Performance, nevertheless, is satisfactory at both intermediate frequencies. The PM speaker is shock mounted. The AM loop antenna is located at the rear of the chassis.

Circuit Design Considerations

A No. 40 panel lamp with a shunt resistor of 150 ohms is used across the heater tap of the 35W4. The rectifier filter circuit consists of two 40 μfd. condensers and a 560-ohm resistor. For an a.c. line voltage of 117 volts, the rectified d.c. voltage is 118 volts and the filtered voltage is 92 volts. The d.c. output current is 80 milliamperes.

TYPE	AM FUNCTION	FM FUNCTION	HEATER VOLTAGE
6BJ6	R.f. amplifier	R.f. amplifier	6.3
12BE6	Oscillator-mixer	Oscillator-mixer	12.6
6BJ6	I.f. amplifier	I.f. amplifier	6.3
6BJ6	—	I.f. amplifier (driver)	6.3
12AL5	—	Ratio detector	12.6
6AQ6	Detector, a.f. amplifier	A.f. amplifier	6.3
35B5	Power amplifier	Power amplifier	35.0
35W4	Rectifier, panel lamp supply	Rectifier, panel lamp supply	32.0*
Total Heater Volts			117.4
Heater current			150 ma.

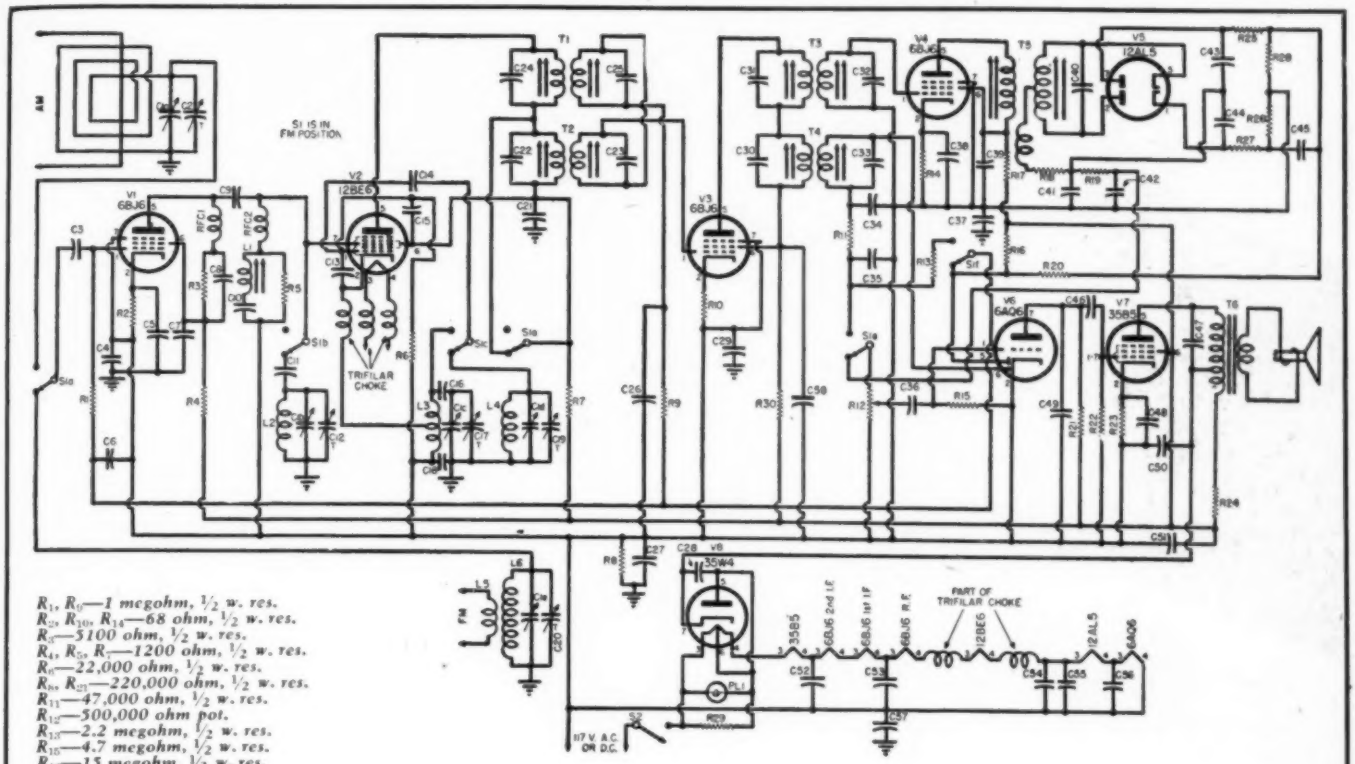
*When a panel lamp is shunted across the 35W4 heater tap, the heater voltage is 32.0 volts. Without the shunt, the heater voltage is 35.0 volts.

Table 1. Tube complement for the a.c.-d.c. operated AM-FM broadcast receiver.

An increase in the power sensitivity of the receiver, is obtained by bypassing the cathode resistor of the 35B5 output tube. The undistorted power output is approximately 0.9 watts and the maximum output is 1.4 watts. The circuit from the grid of the 6AQ6 audio amplifier to the speaker is such as might be employed in a broadcast receiver of conventional design.

The intermediate-frequency for the AM band is 455 kilocycles; for the FM band, it is 10.7 megacycles. The first FM i.f. transformer is overcoupled, the second is undercoupled and a bandwidth of approximately 200 kilocycles at 6 db. is obtained. Although the cathode of the second i.f. amplifier (driver) is bypassed with a condenser, the cathode resistor of the first i.f.

Fig. 2. Circuit diagram and parts list covering an a.c.-d.c. operated AM-FM receiver which covers 530-1620 kc. and 86-111 mc. bands.



R_1, R_9—1 megohm, ½ w. res.
R_2, R_{10}, R_{14}—68 ohm, ½ w. res.
R_3—5100 ohm, ½ w. res.
R_4, R_5, R_7—1200 ohm, ½ w. res.
R_6—22,000 ohm, ½ w. res.
R_8, R_{21}—220,000 ohm, ½ w. res.
R_{11}—47,000 ohm, ½ w. res.
R_{12}—500,000 ohm pot.
R_{15}—2.2 megohm, ½ w. res.
R_{16}—4.7 megohm, ½ w. res.
R_{17}, R_{27}—1000 ohm, ½ w. res.
R_{18}—47 ohm, ½ w. res.
R_{19}—39,000 ohm, ½ w. res.
R_{20}, R_{22}—470,000 ohm, ½ w. res.
R_{23}, R_{26}—150 ohm, ½ w. res.
R_{24}—560 ohm, 2 w. res.
R_{25}—1500 ohm, ½ w. res.
R_{28}, R_{29}—6800 ohm, ½ w. res.
R_{30}—160 ohm, ½ w. res.
C_{1a}, C_{1b}, C_{1c}, C_{1d}, C_{1e}—3-sec. ganged tuning cond. C_{1a}—14-500 μμfd.; C_{1b}—6-28 μμfd.; C_{1c}—11-364 μμfd.; C_{1d}—6-21 μμfd.; C_{1e}—6-28 μμfd. (RCA 272038 or equivalent)
C_{2}, C_{12}, C_{17}, C_{19}, C_{20}—3-30 μμfd. trimmer cond.
C_{3}, C_{34}, C_{35}—100 μμfd. mica cond.
C_4, C_5, C_7, C_9, C_{15}, C_{21}, C_{26}, C_{31}, C_{37}, C_{38}, C_{39}, C_{46}, C_{52}, C_{53}, C_{54}, C_{55}, C_{56}, C_{57}, C_{58}—.005 μfd., 400 v. cond.
C_6, C_{28}—.05 μfd., 400 v. cond.
C_8—10 μμfd. mica cond.
C_{10}, C_{11}, C_{24}, C_{25}*, C_{31}*, C_{32}*—33 μμfd. mica cond.*
C_{13}—4.7 μμfd. mica cond.
C_{14}—22 μμfd. mica cond.
C_{15}—5 μμfd. mica cond.
C_{16}—400 μμfd. mica cond.
C_{22}, C_{23}, C_{29}, C_{30}—232 μμfd. mica cond. (Supplied with T_2 and T_4)
C_{27}—.1 μfd., 400 v. cond.
C_{36}, C_{47}—.02 μfd., 400 v. cond.
C_{40}—56 μμfd. mica cond.
C_{41}, C_{42}, C_{44}, C_{45}—330 μμfd. mica cond.
C_{43}—2200 μμfd. mica cond.
C_{48}—10 μfd., 50 v. elec. cond.
C_{49}—100 μfd., 25 v. elec. cond.
C_{50}, C_{51}—40 μfd., 150 v. elec. cond.
RFC_1—25 t. #32 Formex closewound on 3/16" diam. form
RFC_2—See L_1
L_1—455 kc. wave trap, slug-tuned to resonate with RFC_2 and C_{10} at 455 kc. (RCA 271407 or equivalent, includes r.f. choke RFC_2)
L_2—FM r.f. coil, 5½ t. #18 Formex, 3/16" diam., ¼" long
L_3—AM osc. coil (RCA 272333)
L_4—FM osc. coil, 6 t. #18 Formex, 3/16 diam., ¼" long
L_5, L_6—FM ant. coil, 5½ t. #18 Formex, 3/16" diam., ¼" long, and 2 t. #30 Formex wire which was first twisted around the #18 wire
T_1—10.7 mc. i.f. trans. (RCA 272593 or equivalent)
T_2—455 kc. i.f. trans. (RCA 271846 or equivalent)
T_3—10.7 mc. i.f. trans. (RCA 272594 or equivalent)
T_4—455 kc. i.f. trans. (RCA 271848 or equivalent)
T_5—10.7 mc. ratio detector disc. trans. (RCA 272889 or equivalent)
T_6—Output trans., 2500 ohms to v.c. (RCA 271111 or equivalent)
Trifilar Choke—3 lengths of #28 Formex wire twisted together and then closewound on coil form 9/32" diam., ½" long, 15 t.
S_{1a}, S_{1b}, S_{1c}, S_{1d}, S_{1e}, S_{1f}—6-pole d.t. sw.
S_2—S.p.s.t. sw.
PL_1—No. 40 pilot lamp
1—Loop ant. for broadcast band (RCA 271117 or equivalent)
1—PM speaker, 3.4 ohms to v.c., 4 x 6 inch elliptical (RCA 271058 or equivalent)
3—6BJ6 tubes
1—12BE6 tube
1—35B5 tube
1—12AL5 tube
1—6AQ6 tube
1—35W4 tube
* Supplied with i.f. transformer assemblies, T_1 and T_3.*

BAND	POINT OF INPUT	FREQUENCY*	INPUT VALUE FOR 50 MW. OUTPUT
FM	Second i.f. grid	10.7 mc.	19.0 millivolts
FM	First i.f. grid	10.7 mc.	0.54 millivolts
FM	Converter plate	10.7 mc.	0.075 microamperes
AM	First i.f. grid	455 kc.	3550 microvolts
AM	Converter signal grid	455 kc.	280 microvolts

*Modulated 30% with 400 cycles-per-second.

Table 2. I.f. measurement data covering the home-built AM-FM receiver unit.

BAND	POINT OF INPUT	FREQUENCY*	INPUT VALUE FOR 50 MW. OUTPUT
FM	Converter grid	98 mc.	125 microvolts
FM	R.f. amplifier grid	98 mc.	23 microvolts
FM	Antenna terminals (Over-all receiver sensitivity)	90 mc.	19 microvolts
		98 mc.	23 microvolts
		105 mc.	23 microvolts
AM	Antenna (input from standard loop)	600 kc.	140 microvolts/meter
		1000 kc.	82 microvolts/meter
		1500 kc.	82 microvolts/meter
AM	Antenna (input to 200 μμfd. dummy antenna in series with antenna terminals)		
		600 kc.	16.5 microvolts
		1000 kc.	5.5 microvolts
		1500 kc.	3.6 microvolts

*Modulated 30% with 400 cycles-per-second.

Table 3. R.f. measurement data indicates sensitivity of the AM-FM receiver.

amplifier is unbypassed in order to reduce detuning of the grid circuit of the first i.f. stage with change of bias (a.v.c.). In the AM band only the first i.f. amplifier is used. Its bandwidth at 6 db. is 6.0 kilocycles.

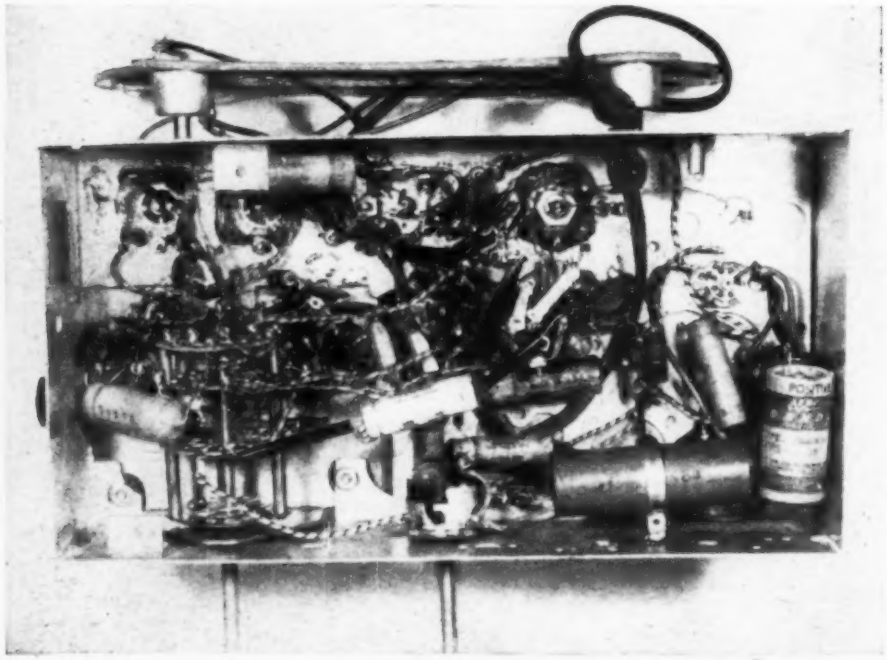
Voltage for a.v.c. is applied to the r.f. amplifier and the first i.f. amplifier. For the AM band, this voltage is derived from the 6AQ6 diode detector. For the FM band, a.v.c. voltage is obtained from the ratio detector. Because the voltage-output ratio of d.c. to a.c. is higher for the ratio detector than for the AM diode, a delay circuit is desirable to prevent the application of a.v.c. voltage until the audio voltage is sufficient to produce maximum output. This delay is obtained by connecting one diode of the 6AQ6 to the a.v.c. for the FM band. Enough current is fed into the diode from the "B+" supply to keep its potential near zero until the a.v.c. voltage at the ratio detector exceeds three volts.

Considerable difficulty was experienced with regeneration in the FM i.f. stages. One of the principal sources of trouble was the audio output side of the ratio detector circuit. In order to reduce feedback, it was necessary to place a metal shield between this circuit and the i.f. stages.

In accordance with preferred a.c.-d.c. practice the a.c. power line is isolated from the chassis and the d.c. circuits are completed through a "B—" lead. The inductive reactance of the "B—" lead is about 1.5 ohms per inch at 10.7 megacycles, so it is not surprising that this lead itself does not constitute an effective ground for the r.f. or i.f. of the FM band. It is necessary, therefore, to bypass the "B—" line to the chassis at several points in order to obtain effective r.f. and i.f. grounding.

The i.f. circuit for the FM band would be the same for an a.c. receiver except for the bypass condensers required between "B—" and chassis. For the particular layout used, the condensers located at the suppressor grid terminals of the 6BJ6 i.f. amplifiers are important in preventing feedback. The locations of some of the other "B—"-to-chassis condensers are also critical. The bypass condensers between the heaters and "B—", and those between "B+" and "B—" or the chassis would probably be needed in any a.c. receiver if the same arrangement of components were used. The bypass condensers are disc-shaped ceramic units with a capacitance of approximately 5000 μμfd.; in most instances, their leads are cut very short. The 12AL5 heater bypass condenser and the bypass condenser from "B—" to chassis near the 12AL5 socket are useful in preventing feedback into the receiver input of the 8th, 9th, and 10th harmonic of the intermediate frequency. The number of bypass condensers required between "B—" and chassis is a function of the design and physical layout of the component parts and will, of course, vary for different layouts.

Fig. 3. Under chassis view of the receiver showing component parts layout.



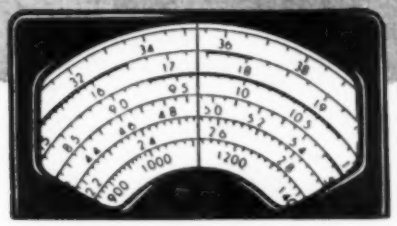
I.F. Stages

The input to each i.f. stage of the receiver for a power output of 50 milliwatts in either band is given in Table 2. At the FM intermediate-frequency of 10.7 megacycles it is difficult to measure the sensitivity of the i.f. system at the 12BE6 converter grid, but an evaluation of the sensitivity of the first FM i.f. stage can be made by measuring the current needed at the converter plate for standard receiver output. This test is made by using a small shielded condenser between the signal generator output terminal and the 12BE6 plate terminal. The condenser constructed for this purpose has a series capacitance of 0.86 μμfd. and a total output capacitance of 2.2 μμfd.; correction for the effect of adding this output capacitance is made by retuning the primary of the first i.f. transformer when the test is made. Because the series reactance of the condenser at 10.7 megacycles is 17,300 ohms, a voltage of 1300 microvolts from the signal generator corresponds to a current of 0.075 microamperes at the 12BE6 plate.

In the absence of feedback, the voltage at the first i.f. grid divided by the current at the converter plate re-

(*Continued on page* 200)

International SHORT-WAVE



***Compiled by* KENNETH R. BOORD**

WE ARE pleased this month to dedicate the *ISW Department* to the *British Far Eastern Broadcasting Service*, Singapore, British Malaya. Thanks to Miss Margaret Ballingall, program executive of the station's staff, and to Paul Kary, Pennsylvania, for this information:

BFEBS grew out of a wartime radio station which was set up in New Delhi, India, by the British Ministry of Information's Far Eastern Bureau. This was a propaganda station, broadcasting to enemy-occupied countries in Asia. It shared the studios of All India Radio. When the war with Japan ended in August 1945, the Far Eastern Bureau was partly dissolved and was partly merged with the Foreign Office's Far East Publicity Division (FEP) which was then working in Kandy, Ceylon, at the Supreme Commander's Headquarters (HQ South East Asia Command).

During October-December 1945, HQ SACSEA moved to Singapore, and with it went the FEP Division. A small radio staff came from Colombo, Ceylon, and from New Delhi. Early in December broadcasting on a small scale was started by FEP, using the Cathay Building studios in Singapore and transmitters of the British Military Administration (Malaya). Incidentally, BMA is now *Radio Malaya*. Identification of *BFEBS* became "This is the Far Eastern Service of South East Asia Command calling in the 31- and 41-metre bands." Programs lasted only one and three-quarters hours daily and consisted of broadcasts in *English*, Dutch, and Japanese. Later in December, Siamese and Indonesian periods were added, giving the station two and a half hours of transmission daily. BMA frequencies used were 9.548 and 7.220.

In the meantime, two SWB-11 transmitters were being shipped to Singapore from India. They were installed on Singapore Island. Delays were numerous, due to breakages in transit, non-arrival of replacements, and a strike of the employees of the local power company. But by January 19, 1946, power had been applied to one transmitter for testing, and erection of the antenna system had been completed. On February 4, the first transmitter began regular operation on 11.735, and the second went on the air on February 25 on 6.770. Two more transmitters were "allegedly" on the way.

From January 30 the station had been broadcasting from its own studios on Thomson Road, and a distinct improvement in technical quality was noticeable. An extended program—of four hours' duration—came into operation on February 25, transmitted on 6.770 and 11.735.

Programs were intended for non-British countries in South East Asia, Malaya itself being served by BMA, *Radio Malaya*. *BFEBS* concentrated on reliable news bulletins—served by an efficient monitoring unit—and talks on many aspects of Britain and the British way of life. Program staff was small. The British members were mostly BBC-trained, but specialization was impossible for everyone had to do a bit of everything. The pace was feverish, the hours long, and illness repeatedly cut down personnel numbers. On one memorable occasion, an overworked woman announcer "took hysterics" when about to enter the studio to read the news. The Chief Engineer snatched the bulletin from her and read it in a strong Midland accent, and so saved the day! The supply of phonograph records was pitifully small and shipments from Britain took many months to reach Singapore. The station had no satisfactory material from which to write talks and had to adapt articles from magazines and newspapers, with copyright hanging like an angry cloud in the background. It was difficult to keep up with requirements, and almost impossible to forge ahead. For example, Miss Ballingall cites a staff report dated May 25, 1946, which said: "Mr. S. (program director) will be going into hospital on Monday for a short course of treatments for dysentery. Mr. B. (announcer, program builder, talks writer) was admitted to hospital on Sunday and expects to remain there for 10 days. Miss O. (announcer, program builder, talks writer, and general organizer) collapsed twice on Friday and was unable to go on duty. Mr. W. (announcer) is still in hospital. Miss M. (record librarian) has been on sick leave since May 11."

Mercifully, the Asiatic staff worked away quietly and well—and in April the station welcomed three Indonesians from Java who initiated a specially-simplified program in Indonesian for village listeners. This had a great deal of success, and the English-program writers also tried to keep their material clear and straightforward so as to appeal to listeners to whom English was pretty much a foreign language.

From June 1, programs were announced as *"The Voice of Britain,"* and all mention of SEAC was omitted.

(*Continued on page* 121)

Through the courtesy of O. Lund Johansen, Copenhagen, publisher of the "World Radio-Handbook," we present this picture from Radio Addis Ababa in Ethiopia. The announcer at the microphone is Miss Romane Worke Karaheen. Addis Ababa transmits on 9.620.

STOP THAT PEDESTRIAN

When something is "going on" in your windows, pedestrians will stop, look, and often enter your store to shop.

By
ALVIN B. KAUFMAN

You can start "selling" your customers on the sidewalk in front of your store with cleverly conceived and executed displays.

STOPPING that pedestrian is a must for the small store. The small store by its very nature receives a considerable percentage of its business from "walk in" unpremeditated purchase-minded pedestrians.

Much consideration has been given to this subject, but perhaps not enough in practical rather than the theoretical approach. This article will discuss both phases, with some concrete practical applications shown.

The best way to get a customer into a small store, is to have him see something that appeals to him in the window display, either from the viewpoint of a bargain or that will strike him as being particularly desirable. *The main problem then* resolves itself into getting the pedestrian to look at the window display. This article cannot specify a "bargain" or unusually desirable object as this depends upon location and type of merchandise handled. This article can and will explain how to "stop that pedestrian" so that he will look at your window display.

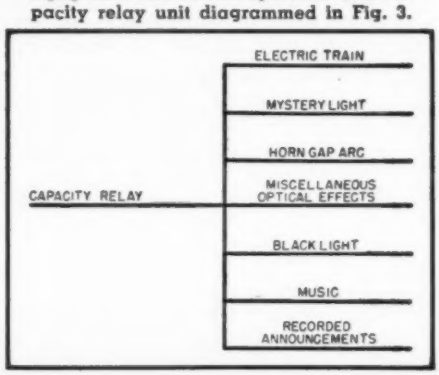
The first axiom that applies is that a "static" window, irrespective of its dressing, will rarely have the appeal of an "active" window. By "static" we mean a window with no change of light, sound, or motion. A "static" or non-changing object does not register on the mind or eye of anyone engaged in thinking or talking as he or she passes your store. That is why stop lights, aircraft and aircraft marker lights blink; they are thus drawn to the attention of the individual quickly.

As indicated above an "active" window must be used. Where possible, participation of the pedestrian in causing the action is very excellent and will cause more personal interest and inspection of the window display.

The three phases of light, sound, and motion will be discussed separately as each has its good and bad features.

Light is limited in its uses, especially during the daylight hours. Turning the window lights on and off by means of an automatic switch is not good. Having the pedestrian operate the lights by walking in front of the window (by photo or capacity relay) is not much better. In both cases there is nothing *in* the window display *to attract* and *hold* attention. Light, when used in a window, should consist of a trick or novel device intriguing to young and old alike. Two good versions are the trick light bulb which lights without any connecting wires or the horn gap traveling arc. The trick electric light bulb may be done several ways. The first is to remove the base of the lamp and short the wires, replacing the base with glue. If this lamp is placed on a dish and the dish placed on a concealed electro-magnet (or coil) the induced e.m.f. will cause the lamp to light. This method is needlessly expensive. A simpler and almost as good solution is the following: A 25 watt colored lamp of the round glass type must be used. Here wires are soldered to the base of the lamp and the lamp is placed on a cloth and supported by sand all around the lamp. Then the base from another lamp is glued on to the top of the colored lamp. The colored lamp then looks as if it is resting, base up, on a pile of sand. This is shown in Fig. 1. A blinker should be used with the light.

Various pieces of "crowd stopping" equipment that can be operated with capacity relay unit diagrammed in Fig. 3.



The horn gap traveling arc is good day or night. It possesses all three pedestrian-stopping features—light, sound, and motion. Two copper rods or pieces of tubing are supported on high voltage standoff insulators, spaced several inches apart. These tubes, standing vertically, are bent in towards each other to within about an inch and then out about four to six inches and then carried some 20 to 24 inches high. Any good *neon* transformer of about 15,000 volts is connected to the bottom of the horn gap. A neon type transformer *must* be used, no other type is suitable. With the power on, an arc will start across the narrowest part of the horn gap and will rise to the top of the horn and will go out with a pop. The spacing of the horn gap should be adjusted so

that an arc just starts at the bottom of the horn; this depends upon the transformer voltage. Under these conditions of operation the transformer would overheat under continuous operation, so some means must be supplied for an operation cycle of about one or two minutes, two to four minutes off. This horn gap is very spectacular and will attract pedestrians.

Another light version, not too applicable for daytime, is the use of ultraviolet (black light) lamps to cause interesting things to happen when the tungsten lamps are shut off and the ultraviolets go on. This should be done automatically every few minutes. Fans painted with ultraviolet paints, or trick scenery is effective.

One last but important use of light is the cathode-ray oscilloscope. With a microphone in front of the window and an oscilloscope inside, facing out, an invitation to *"See Your Voice"* is quite a crowd gatherer.

Sound has few uses. Music or speech as played over a p.a. system does not attract much attention to the store *windows*. The sound to be effective should apparently emanate from the store window, or in any case be directly connected in some way to the window. One method is sound over a light beam. Using a phonograph to modulate a flashlight bulb or neon bulb, this light is focused onto a photocell and a high gain amplifier which plays the music over a speaker in front of the store. To be effective the light beam must be carried through the plate glass window where the pedestrian can interrupt the light beam, as per printed instructions, and thus stop and start the music. This method is shown in Fig. 3.

Motion is probably by far the best method of gathering a crowd of pedestrians. A crowd grouped around a window in itself attracts other pedestrians and motorists. Getting the gathering started is the hard part. Normally a person will not hesitate too long at a window irrespective of the attraction unless he can participate. A capacity relay may be used to enable our "customer" to participate. The capacity plate (or detection plate) is camouflaged in the window as shown in the photo taken of the *Ideal Radio & Appliance Store's* display in Los Angeles. The plate says, "Touch Here

(*Continued on page* 154)

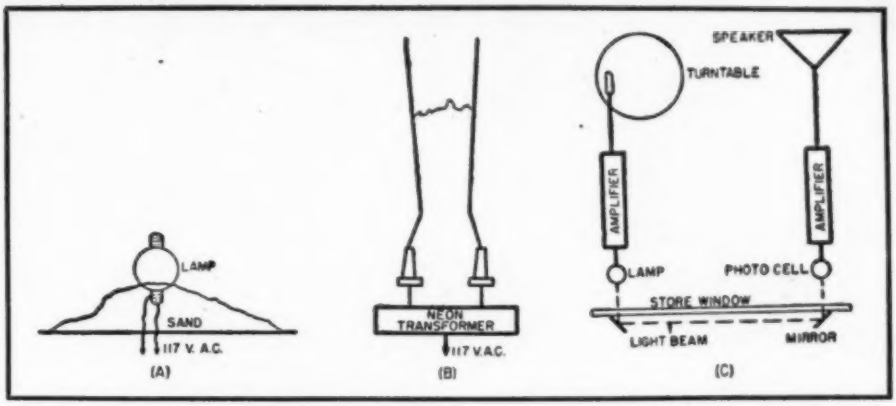


Fig. 1. Three versions of popular "crowd stoppers" discussed in the text.

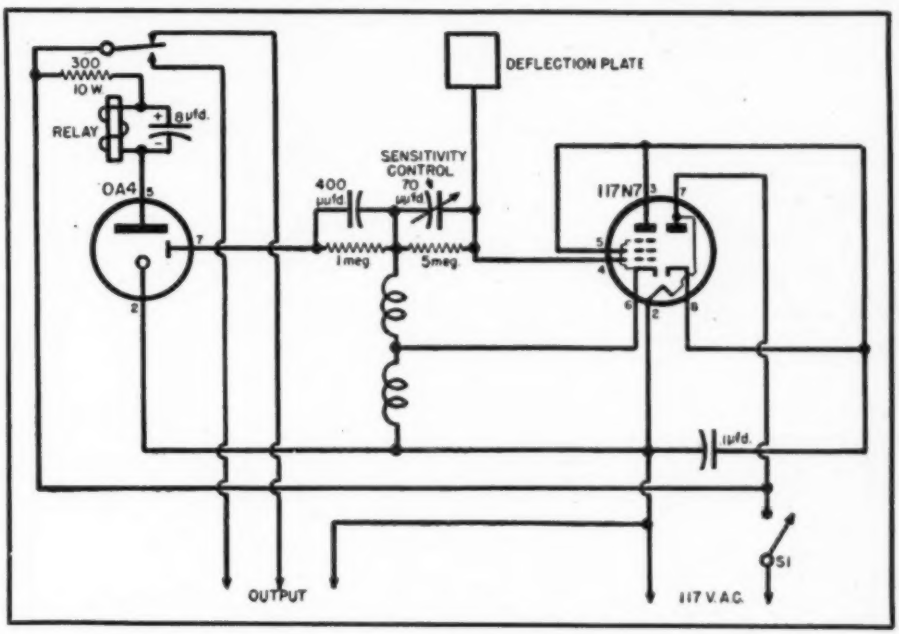


Fig. 2. Circuit diagram of an easily-constructed capacity relay unit.

This group assembled in front of the show window was attracted by a television console in operation during evening hours.

A capacity operated relay that is always a good attraction for customers. The metal sign helps conceal circuit wires.

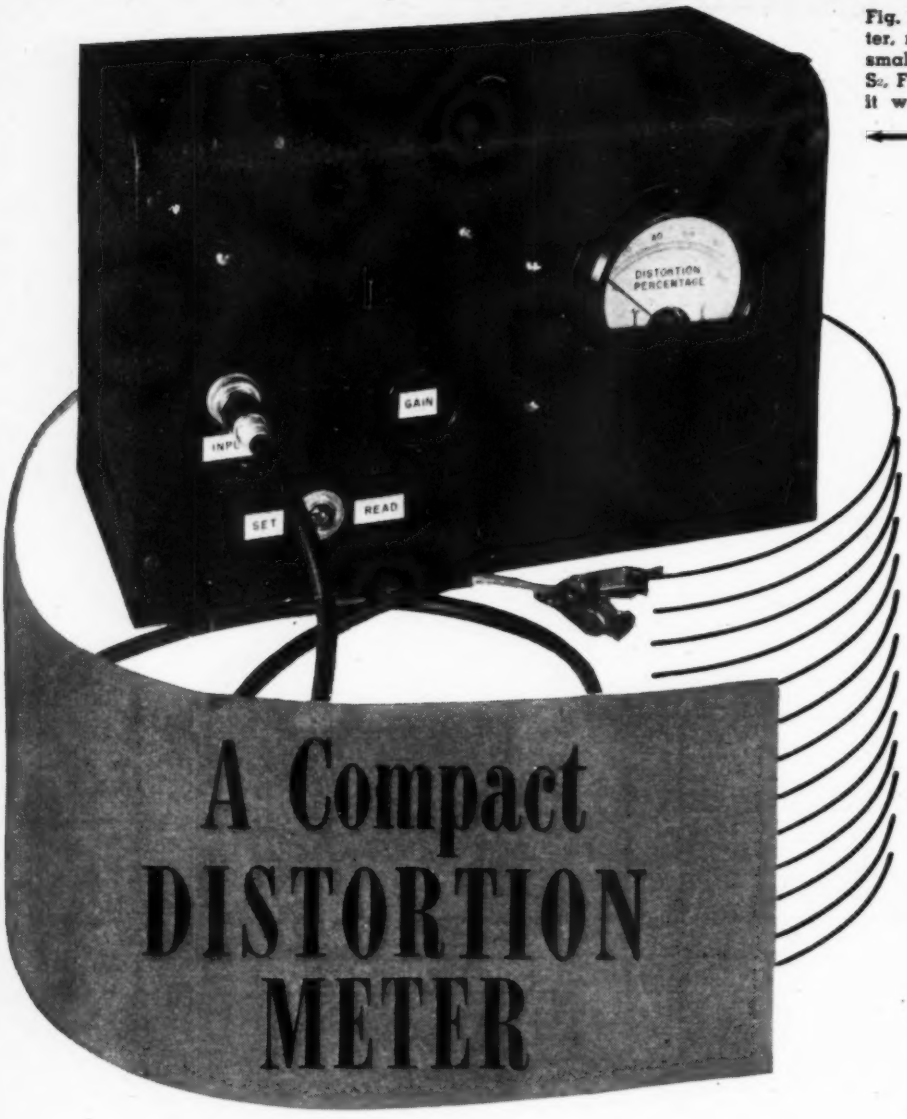


Fig. 1. The completed home-built distortion meter, ready for use. Note the few controls and small size of the instrument. The range switch, S_2, Fig. 4, is not shown on this assembly since it was added later as an extra refinement.

A Compact DISTORTION METER

By

RUFUS P. TURNER

W1AY

Complete details on an easy-to-build, tubeless, and batteryless test unit. Instrument is direct reading and as simple to use as any voltmeter.

AMPLIFIER servicemen do not question the importance of distortion measurements. But the actual making of these measurements continues to be an untackled job in most shops where audio equipment is checked. While most servicemen are quick to admit that ear estimates of distortion are miserably inadequate, they maintain that oscilloscopic methods of distortion measurement are too complicated and slow and are poorly explained in semi-technical literature.

We have talked with a large number of servicemen on the subject and learn that most of them want to measure distortion and are willing to build a *simple,* inexpensive meter for the purpose. However, they insist that a suitable distortion meter have the following features: (1) be as simple to operate as a non-electronic volt-ohmmeter; (2) give direct readings of *distortion percentage,* therefore require no calculations in its ordinary use; (3) operate without tubes, batteries, or power supply; and (4) require no complicated laboratory equipment for adjustment and calibration.

With these requirements in mind, we undertook the design of a simple distortion meter, the constructional details of which are given in this article. This meter is not a precision laboratory instrument, but its accuracy is comparable to the usual run of home-made radio test meters and it will be found entirely adequate for the busy serviceman. The indicating meter (reading direct in distortion percentage) is actuated by a germanium crystal diode, so no tubes, power supply, nor zero adjustment is required.

Operation of the instrument is based upon a simple principle used in several commercial distortion meters. With the thought in mind that an understanding of how the meter operates will enhance its usefulness to the user, we devote the next few paragraphs to an explanation of the operating principle.

Operating Principle

Fig. 2 shows the functional setup of apparatus for checking audio amplifier distortion. The distortion meter is the portion of the circuit enclosed within dotted lines. A test signal from a low-distortion audio oscillator is fed into the input terminals of the amplifier under test. The distortion meter is connected to the voice coil of the loudspeaker. If the test is to be noiseless, the speaker voice coil may be replaced with an equivalent load resistor.

Operation of the test circuit is explained in the following manner: Amplifier output voltage is applied to the distortion meter circuit. The bridged-T network (comprised of choke coil CH_1 identical condensers C_1 and C_2 and resistor R) suppresses the fundamental frequency of the amplifier output signal but allows the harmonics to pass with very slight reduction.

The output voltmeter accordingly will be deflected, to all practical intents and purposes, only by the voltage due to the total harmonics present in the amplifier output, and this meter may be graduated in distortion units. The input voltmeter, on the other hand, will read the voltage of the complex audio wave (fundamental and harmonics, depending upon phase relations between the various components). The prime purpose of the input voltmeter is to standardize the input voltage at a certain value upon which the calibration of the output voltmeter depends. The ratio of the voltmeter readings will give the distortion factor with sufficient accuracy for amplifier service applications. If distortion percentage readings are taken directly from a special scale on the output voltmeter, the input voltage must always be set first to an agreed standard value.

All distortion measurements with this type of distortion checking circuit must be made with the test oscillator set to the null frequency of the CH_1-C_1-C_2-R network. Other frequencies may be employed, however, if the bridged-T circuit values are altered properly to provide null points at those frequencies. By proper selection of choke CH_1, with respect to condensers

C_1 and C_2, the bridged-T network can be designed for complete removal of the fundamental frequency with negligible effect upon the harmonic frequencies.

From the foregoing explanation, it is seen that this type of distortion-measuring circuit is a distortion *totalizer*. That is, it indicates the total distortion voltage, rather than evaluating the various harmonics separately. It is this total distortion which is of chief interest to the amplifier serviceman.

Circuit Simplification

The distortion-measuring circuit in Fig. 2 can be simplified by eliminating one of the voltmeters. Input and output voltages then may be read successively on the remaining meter scale by arranging to short-circuit choke CH_1 when reading input voltage. A simple arrangement for accomplishing this result is shown in Fig. 3. The switch, S_1, is closed to read input voltage and opened to read output voltage (distortion).

A full-wave *square-law* v. t. voltmeter usually is employed as the indicator in the distortion-measuring circuit. This type of voltmeter has found favor since it gives good accuracy when used on voltages of complex waveform. The full-wave square-law instrument does not discriminate strongly against the harmonics present. The circuit may be simplified still further, however, by employing a germanium crystal diode and d.c. microammeter in place of the v. t. voltmeter (see Fig. 3). While the crystal-microammeter combination forms an *average*-reading voltmeter which reads only the positive half-cycles, the harmonic error of this type of meter is not prohibitive in service test applications, provided the signal voltage is kept high enough to give linear response. We can get along with reading only positive half-cycles, since in the usual run of amplifier service practice the second harmonic (which, like the other even-numbered harmonics, shows up on the positive half-cycle) usually is the predominant and most troublesome distortion component. Also, the odd-numbered harmonics tend to distort the wave symmetrically; that is, they affect both positive and negative half-cycles in the same way.

Complete Instrument

The finished distortion meter, employing the principles just explained, is shown in Figs. 1 and 5. The circuit schematic is Fig. 4A.

The bridged-T network components (C_1, C_2, CH_1, and R_3) have been selected for 400-cycle operation. Distortion measurements accordingly must be made at that frequency. A single-frequency test will be useful and adequate in most cases. However, the null frequency of the network may be shifted, if the operator desires, simply by changing the capacitances. For example, 1000-cycle operation will be obtained if C_1 and C_2 are changed to .02 microfarad each. The bridged-T circuit shown in Fig. 4A offers almost no attenuation to the 2nd, 3rd, and 4th harmonics of 400 cycles.

In its *"SET"* position, switch S_1 short-circuits the network to permit adjustment of the input voltage, by means of gain control R_1, to the full-scale value of the meter. In the *"READ"* position of switch S_1, the network is in the circuit to remove the fundamental frequency.

The audio-frequency voltmeter consists of the 0-100 d.c. microammeter, M, a 1N34 crystal diode, and multiplier resistor R_2. The specified microammeter has two advantages: It provides a voltmeter with fairly high input resistance, and its 0-to-100 scale may be read directly in percentage dis-

(*Continued on page* 164)

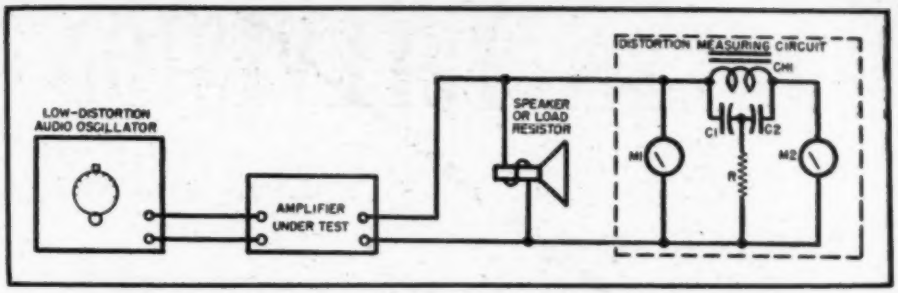


Fig. 2. The equipment setup which is used for distortion checking.

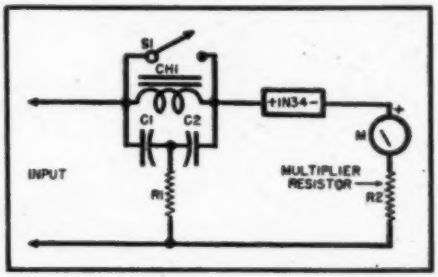
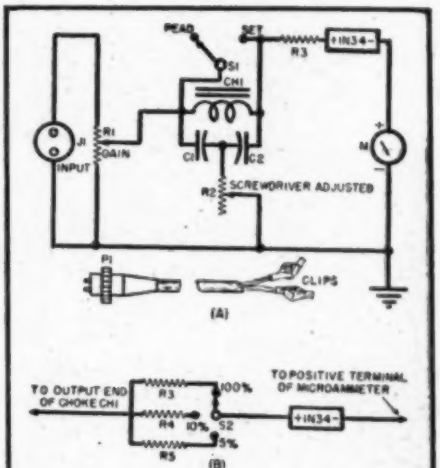


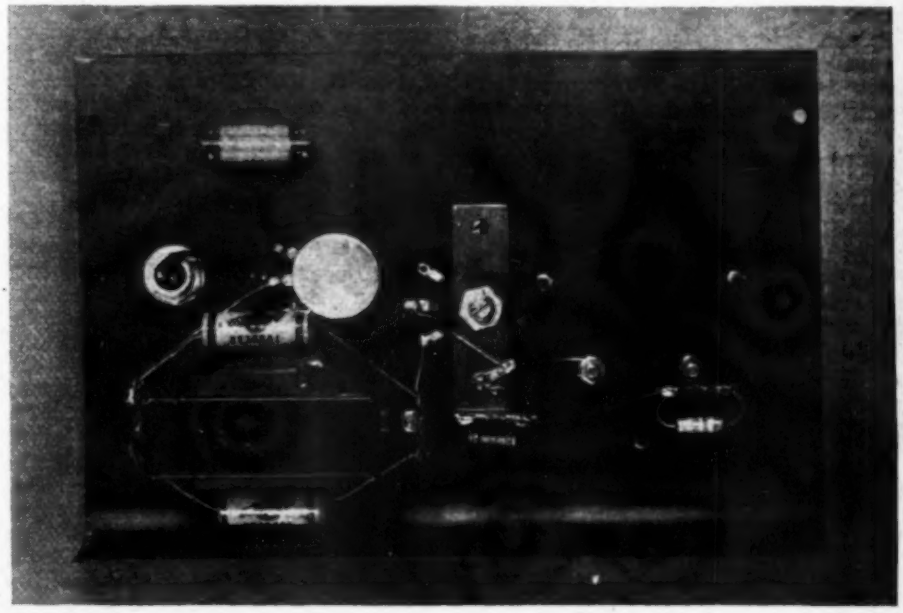
Fig. 3. Single-meter circuit.



R_1—1000 ohm wirewound pot.
R_2—1 megohm pot.
R_3—40,000 ohm, ½ w. res.
R_4—3000 ohm, ½ w. res.
R_5—600 ohm, ½ w. res.
C_1, C_2—.05 μfd., 400 v. cond. (close tolerance)
CH_1—8 hy., 150 ma., 200 ohm filter choke
J_1—2-contact female chassis connector (Amphenol 80-PC2F)
M—0-100 d.c. microammeter
P_1—2-contact male cable plug (Amphenol 80-MC2M)
S_1—S.p.d.t. toggle sw.
S_2—S.p. 3-pos. range sw.
1—1N34 crystal diode

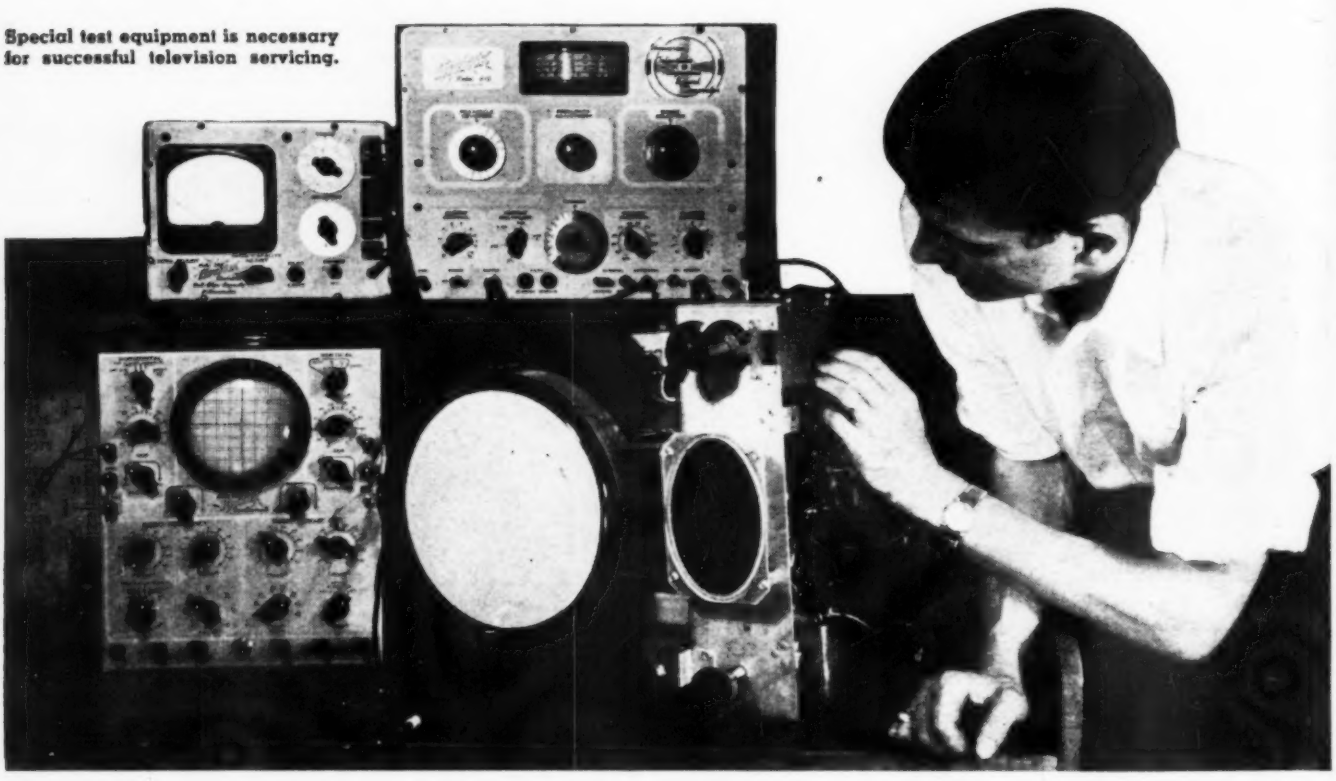
Fig. 4. (A) Circuit diagram of distortion meter. (B) Circuit of meter range switch.

Fig. 5. Inside view of instrument. All components are mounted on back of front panel.



MODERN TELEVISION RECEIVERS

By MILTON S. KIVER



Special test equipment is necessary for successful television servicing.

Part 8. A discussion of the various coupling networks used in TV receivers and video i.f. alignment procedures.

COUPLING networks between stages in the video i.f. system of modern television receivers use either stagger-tuning, transformer windings, or complex arrangements of condensers and coils. In the previous article, we considered the various forms of stagger-tuned and transformer-coupled networks; now let us turn our attention to complex-coupled systems. Into this category fall such receivers as *Philco, DuMont, Stromberg-Carlson,* and *United States Television.*

In the *Philco* video i.f. system, Fig. 1, all interstage circuits are capacitively coupled. Thus, L_1 leading to the input i.f. amplifier transfers its energy to L_2 through C_1 and C_2. For alignment, L_1 and L_2 are peaked to different frequencies and then C_2 is adjusted to provide the desired bandwidth. The trick here is to achieve the proper bandwidth without permitting any appreciable dip to appear in the center of the response curve. In this input network, all signals between 28.1 and 22.1 mc. are permitted to reach the amplifier tube, 6AG5. The audio i.f. signal is then transferred to the audio system from the plate of the input i.f. amplifier. In the second coupling network located between V_1 and V_2, the accompanying audio i.f. voltage is sharply attenuated by the trap consisting of L_3, C_3, C_4 and R_1. (The reader will recognize this as a Bridged-T network). L_4, L_5, and C_5 form the video i.f. coupling network similar to L_1, L_2, C_1, and C_2. The bandpass of this network is restricted to the 4.0 mc. required by the video i.f. frequencies.

The third coupling network between V_2 and V_3 is similar to the second circuit but the trap frequency is now at the adjacent sound carrier frequency (28.1 mc. in this instance). The final coupling network between V_3 and the video detector is without a trap. Additional trap circuits do exist in this receiver but they are situated beyond the video detector. 26.6 mc. is the video carrier i.f. value.

The gain of the first two amplifiers, V_1 and V_2, is automatically controlled by an a.g.c. voltage. The contrast control is completely divorced from the a.g.c. system, being located in the cathode leg of the final video-frequency amplifier feeding the cathode-ray tube. *United States Television* employs a similar circuit in some of their earlier models.

Stromberg-Carlson, in the 10" CRT receivers, uses the interstage coupling system shown in Fig. 2. Between each stage there are two sets of permeability tuned coils, capacitively coupled to each other. There is no direct inductive coupling between the coils. In each case the coils are peaked to provide the desired bandwidth. Five traps remove possible interference from higher and lower adjacent channels in addition to the sound signal of the channel being received. The first three i.f. stages contain both audio and video signals, necessitating a 5.0 mc. response. Due to the presence of the audio signal, the trap circuits in these stages remove only the audio and video carriers of the adjacent lower channel. After the audio has been separated and transferred to its own system, a sound trap (21.6 mc.) is introduced. At the same time a trap for the video carrier of the adjacent higher channel (20.1 mc.) is also placed in the circuit. The 20.1 mc. trap is purposely inserted beyond the audio separation point because it tunes quite close to the audio carrier frequency (21.6 mc.) and it would attenuate the audio signal if placed in

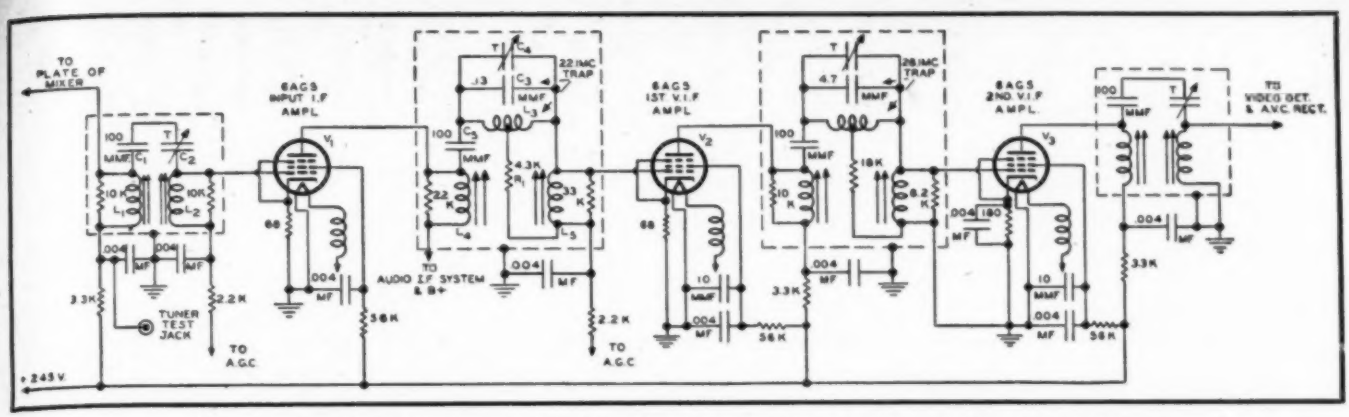


Fig. 1. The video i.f. system employed by Philco Corporation in its line of television receivers.

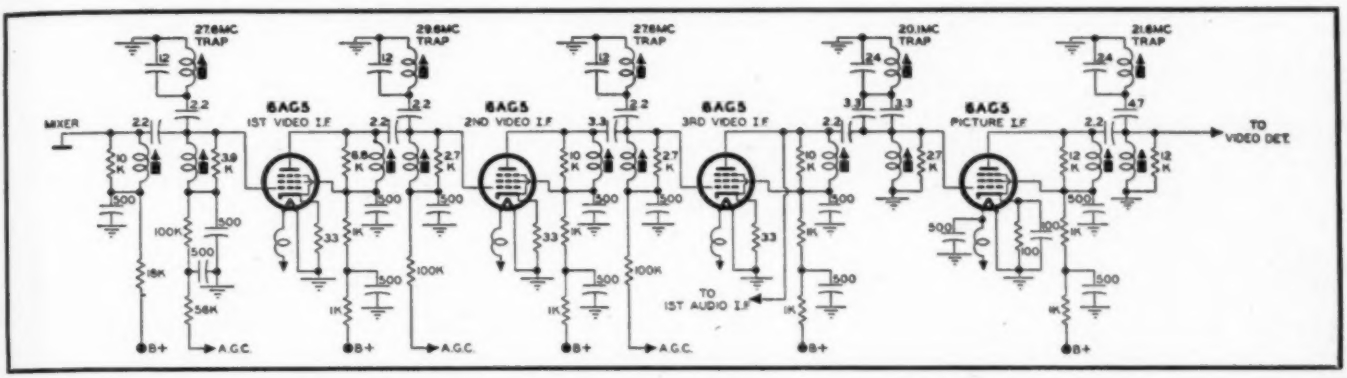


Fig. 2. The video i.f. system used in the 10 inch series of Stromberg-Carlson video receivers.

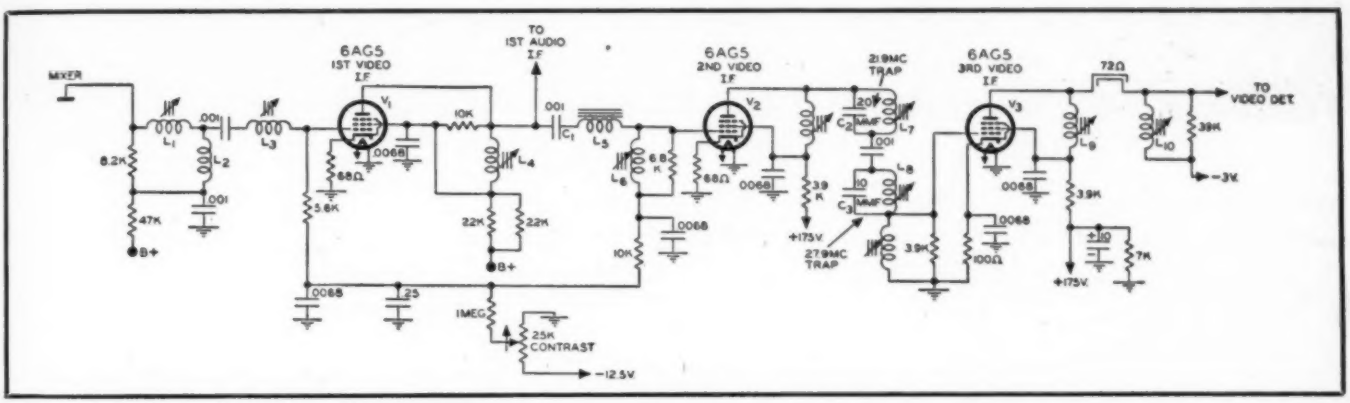


Fig. 3. The complex-coupling network employed in Stromberg-Carlson's 12 inch CRT series receivers.

a stage handling the audio voltage.

The presence of the 29.6 mc. trap is unusual since generally only a 27.6 mc. trap is employed to reduce any possible interference arising from adjacent higher channels. The manufacturer probably felt that an additional trap here would help reduce even the strongest interference that might be encountered from this source.

Stromberg-Carlson's 12" CRT television receivers use an entirely different arrangement—one which is very similar to the system found in *DuMont* sets. The basic circuit, which is found also in *DuMont* model RA-103 sets, is shown in Fig. 3. The complex coupling network between the converter and the first i.f. amplifier tubes employs a common inductance, L_2, to couple the energy from L_1 to L_3. In the second interstage coupling unit, the transfer of energy between L_4 and L_6 occurs through L_5. C_1, and its equivalent in the first network, serves merely to block the passage of d.c. from the plate of the preceding tube to the grid of the following tube. In this second transfer network, too, the audio i.f. is picked off and applied to the 1st audio i.f. stage. In the third interstage network, two parallel resonant traps are placed in series with each other and the signal. L_7 and C_2 are peaked to 21.9 mc. (the accompanying sound) while L_8 and C_3 are resonated at 27.9 mc. (the sound carrier of the adjacent lower channel). These are the only two traps besides the audio pick-off circuit. The final coupling network between the third i.f. amplifier and the video detector is unique in that it employs the capacitance and inductance of a short section of 72-ohm transmission line to couple the signal from L_9 to L_{10}. The *over-all* response of this system is 4.0 mc. with sharp attenuation at either end of the response curve because of the trap circuits. This system is best adjusted by first aligning each stage separately and then running a check on the entire system. The type of response curves that can be expected at each point will be noted when the alignment procedure for i.f. systems is discussed.

The video i.f. circuits for the *DuMont* models RA-101 and RA-102 (shown in Fig. 4) will present no additional problems since each of the circuits has already been discussed.

Video I.F. System Alignment

Alignment of the video i.f. coils (or transformers) and the trap circuits is one of the first adjustments made in

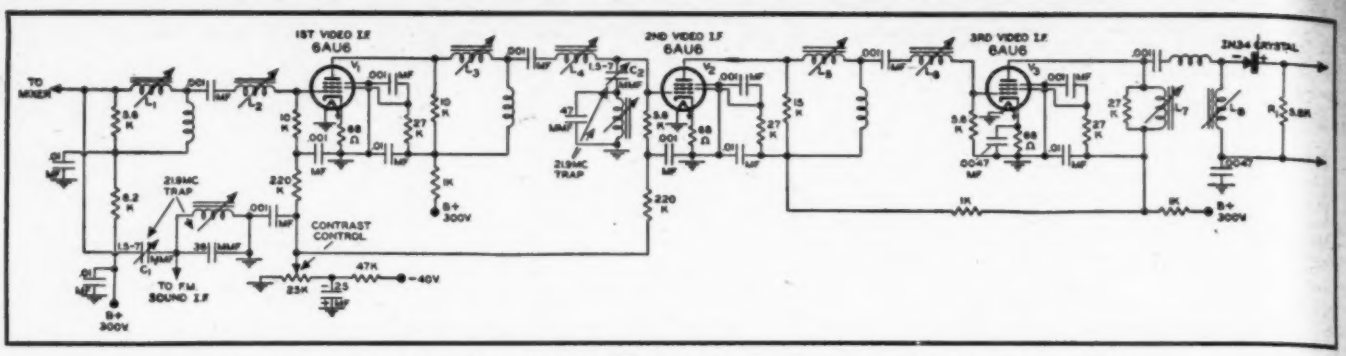


Fig. 4. The video i.f. section of the DuMont Models RA-101 and RA-102 television receivers.

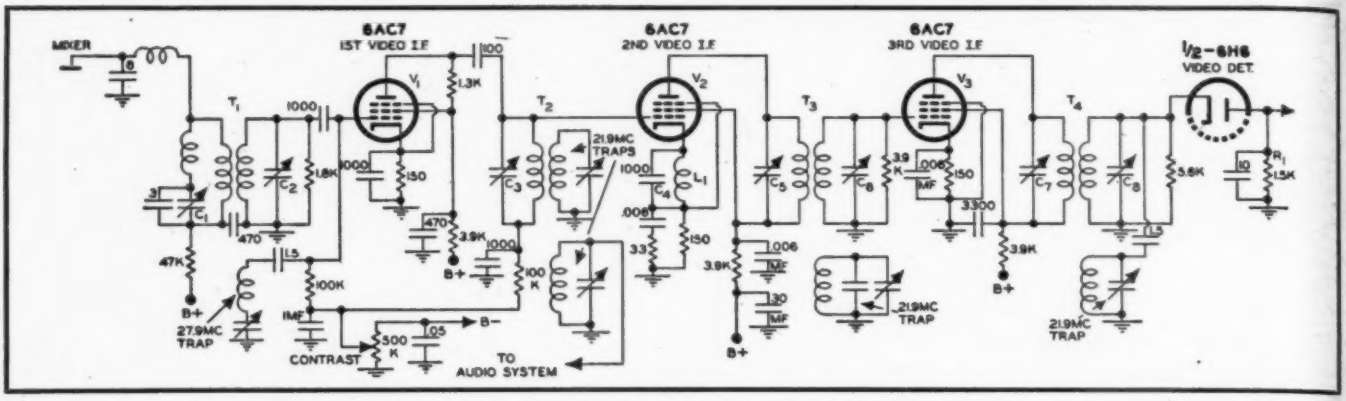


Fig. 5. The video i.f. system employed in General Electric Company's Model 802 video receivers.

a television receiver. As noted previously, the ideal form of the video i.f. response is established by the type of transmission that has been standardized by the FCC and each i.f. system is adjusted until its response is as close as possible to this desired form. Where the manufacturer specifies curves which deviate from the ideal form, the reason can generally be traced to one of the following:

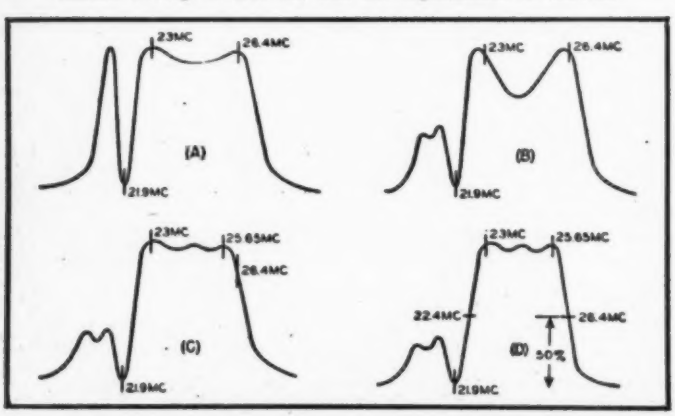
1. A compromise between economy and the most desirable image.
2. The use of a 7 inch (or smaller) C.R.T. Video i.f. bandwidths as low as 2.5 mc. will produce an acceptable picture on screens 7 inches in diameter or less.
3. Compensation at various sections of the response curve in order to offset excessive losses at other points in the signal path. (Thus, peaking the high-frequency end of the curve is sometimes suggested by the manufacturer in order to offset losses of these frequencies in other circuits of the receiver.)

The equipment required for a complete alignment includes:

1. A sweep signal generator possessing a tuning range from 15 to 30 mc. and a sweep width of at least 6 mc.
2. An AM signal generator; that is, one capable of generating one signal at a time. Desired tuning range—15 to 30 mc.
3. An oscilloscope.
4. A v.t.v.m.

Items 1 and 2 need not necessarily have the limited frequency ranges specified. More probably—and certainly more economically—these ranges would be part of a more extensive coverage incorporating the r.f. frequencies as well. When the serviceman sets out to purchase test instruments—especially signal generators—he should list all frequencies ordinarily encountered in his service work and then attempt to obtain an instrument capable of covering as many of these frequencies as possible. Not only will this permit the work bench to remain as uncluttered as possible, but it often reduces the total expenditure. A scope, a sweep generator, and a television set on one bench will leave very little space for any additional equipment.

Fig. 6. The response curves of the G.E. video i.f. system shown in Fig. 5. See the text for explanation of curves.



To the man who has been accustomed to working on AM sets, the necessity for employing an oscilloscope to align and adjust a television set is sometimes open to skepticism. After all, visual alignment is not essential to the adjustment of AM sets. However, there are several important differences between AM sound receivers and television receivers. In the first place, the bandwidth of an AM sound i.f. system does not exceed ±5 kc. Thus, a simple peaking adjustment of the i.f. coil or transformer will permit as accurate an adjustment as we ordinarily require. In television sets the bandwidth is 4.0 mc. or wider and peaking a coil to cover a bandpass this wide is not practicable. Second, AM sound signals are transmitted with identical upper and lower sidebands. In the receiver, peaking of the coils produces an equal response on either side of this peaking frequency and both sidebands receive equal amplification. In television broadcasting, only the upper sideband is present in its entirety. This requires a non-symmetrical response in the receiver. Again we come back to the basic difference between sound and video i.f. systems, namely, form of the i.f. system response curve. There is no quick and simple method of aurally checking a video i.f. response. You must see the curve to determine whether or not it has the proper form.

(*Continued on page* 137)

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• NATIONALLY KNOWN MAKE • EASY TO INSTALL • A PRICE YOU CAN AFFORD

THE SPEAKER FOR HIGH FIDELITY

Designed by one of America's finest speaker builders, for FM high fidelity radios, record players and P.A. systems. This speaker is incorporated in radios selling in the $500.00 bracket. It is especially designed 12" Alnico V magnet PM with built-in 3" Alnico V tweeter. The high-pass filter is concealed under the pot cover. Just hook to any 8 ohm voice coil. (Will hook in place of any house radio speaker, as most speakers have 8 ohm voice coils), only two wires to connect. Will handle approximately 18 watts. This coaxial PM speaker should sell for $35.00. Why buy an ordinary speaker, when we are offering a co-axial Alnico V PM for only $12.95? Latest 1948 production, not surplus. All speakers are guaranteed new and perfect. Stock No. 4-12X. Weight 8 lbs.

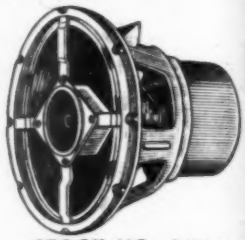
COAXIAL 12-INCH ALNICO V P.M. SPEAKER

TWO IN ONE

FREQUENCY RESPONSE 50 TO 10,000 CPS

REGULAR $27.50 LIST

$12.95 EACH TWO FOR $24.95



STOCK NO. 4-12X

OUR LEADER

★

12" COAXIAL PM SPEAKER

$9.95 TWO FOR $19.00

Model 12-RN—Our leader 12" coaxial PM speaker, with 3" tweeter. Equal to above model 4-12X except tweeter will not respond to as high a frequency. Matching network is built-in; hook to any 8 ohm output. Will take 15 watts. Weight 12 lbs. Net $9.95, 2 for $19.00.

A 5" P.M. 6 INCH AND LARGER SENSATIONAL PRICES

6" 1.5 oz. Alnico V PM speaker.....$1.49
6" 2.15 oz. Alnico V PM speaker..... 1.98
4x6" 1.5 oz. Alnico V PM speaker... 1.49
6x9" 3.16 oz. Alnico V PM speaker... 2.98

1948 PRODUCTION 4" and 5" and 6" P.M. SPEAKERS

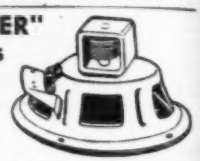
Unbeatable Prices

McGee offers the answer to your replacement speaker problems. All fully guaranteed first line run (not odds and ends), with Alnico V magnet and standard RMA 3.2 ohm voice coils. Made by the Perfection Speaker Company. Cadmium plated with dust cover and output transformer bracket. The small size pots make them adaptable to tight fitting places. All sizes have the same size magnet width and depth. 2½" pot size only 1¼" by 1¾". Packed 24 to the case. These are the choice of our local service crowd.

3½" square frame 1 oz. magnet speaker.....$0.99
4" square frame 1 oz. magnet speaker..... .99
4" square frame 1½ oz. magnet speaker..... 1.19
5" round frame 1 oz. magnet speaker..... .99
5" round frame 1½ oz. magnet speaker..... 1.19
6" square frame 1 oz. magnet speaker..... 1.49
6" square frame 1.47 oz. magnet speaker..... 1.69

"OUR LEADER" IN 12" P.M.'s

Only $4.95



12" 6.8 Oz. Mag. P.M. Speaker $4.95

Nationally known 12" 6.8 oz. Alnico V PM, with 1" 8 ohm voice coil. Will take 15 watts. Grey finish. Our leading 12" speaker. Stock No. CH-12. Net, $4.95.

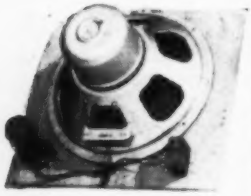
12" 12 Oz. Mag. Will Take 20 Watts $8.95

Super heavy duty 12" 12½ oz. Alnico V magnet PM with 1¼" with 8 ohm voice coil. This speaker is equal to 60 oz. of old type magnet. Will take 25 watt peak. Stock No. CH-13—$8.95; two for $17.00.

P.M.'s WITH OUTPUTS ATTACHED

6½" 1.47 oz. Alnico V PM with PP 50L6 output.....$1.95
5" 1.47 oz. Alnico V PM speaker with 50L6 output.....$1.49
5½" Utah, 2.15 oz. Alnico V PM speaker with output transformer to match 3Q5 tube. $1.95
4"x6" Alnico V PM with 50L6 trans..$1.69
4" 1.47 oz. Alnico V PM with 50L6 trans. $1.49

THEATRE TYPE TWIN SPEAKER, $29.95
With "University Lab" Tweeter
PLUS CINAUDAGRAPH 15" P.M.



Our sound laboratory has assembled this fine speaker combination. A super heavy duty 15 inch cinaudagraph Alnico V PM and a University Lab. trumpet type high frequency tweeter. Ready-cut plywood baffle and cut to fit grill cloth. All you do is bolt speakers to the baffle and connect in the 4 mfd. high pass filter. This combination will take 35 watts of audio and reproduce 40 to 10,000 cps. A speaker combination of theatre quality. Stock No. BW-3L. Net $29.95. If a baffle cabinet is desired, order the L-25 below.

University Lab. high frequency tweeter trumpet with connecting instruction. Same tweeter as used on the above theatre combination. Net..... **$11.76**

A $75.00 VALUE LIST

WALNUT 15" BAFFLE, $19.95

FLOOR MODEL

Heavy Rattle Proof Construction

Wainut floor type speaker baffle. Size 12x22x26 inches. Will accommodate either 12 or 15 inch speakers. Air relief cutouts in corner of grill. Weight 30 lbs. A $25.00 value for only $19.95. Stock #L-25. Net $19.95. Why not order one of these with any of the speakers listed in adjacent copy?

A SPEAKER FOR YOUR EVERY NEED

At a Big Saving

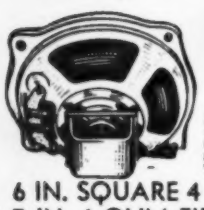
10" 4 oz. Alnico V magnet PM speaker.....$3.95
10" 7 oz. Alnico V magnet PM speaker..... 4.45
12" 7 oz. Alnico V magnet PM speaker..... 4.95
For radio set and amplifier use. 12" 15 watt, 8 ohm voice coil Alnico V PM. A scoop for $4.95, 5 for.....22.50
4" 450 ohm field speaker..... 1.89
5" 450 ohm field speaker..... 1.89
4" 4 ohm field speaker for auto sets..... 1.89
5" 4 ohm field speaker for auto sets..... 1.89
5" 450 ohm field speaker, with output transformer to match single 50L6 tube 1.98
8" 450 ohm field speaker with output transformer to match single 6V6 tube 2.25
8" 1000 ohm field speaker..... 2.95
6" square 1000 ohm field speaker, with 7000 ohm output transformer.. 1.95
12" RCA 450 ohm field speaker, ideal for console radio replacements... 4.95

P.M. SPEAKERS with FAMOUS ADJUSTABLE CONES

"The Finest Money Will Buy"

The voice coils on these speakers are mounted to an adjustable metal rim, that can be shifted several thousandths of an inch. The cream of the speaker production. Nationally famous maker. More output per watt.

5" 1½ oz. Alnico V magnet PM. $1.49
5½" 2.15 oz. Alnico V magnet PM. 1.98
6" 2.15 oz. Alnico V magnet PM. 2.49
6" 3.16 oz. Alnico V magnet PM.. $2.98
8" 2.15 oz. Alnico V magnet PM.. 2.98
8" 3.16 oz. Alnico V magnet PM.. 3.98
12" 7 oz. Alnico V magnet PM.. 6.95



MAGNAVOX SPEAKERS

DOWN TO EARTH PRICES

AUTO REPLACEMENTS

A red hot McGee special. Latest 1948 production Magnavox auto radio replacement speakers. Same as used in original equipment. 4 ohm field and standard voice coils. Every speaker is guaranteed. They will take the wallop of any car radio.

6 IN. SQUARE 4 OHM FIELD..... $2.49
7 IN. 4 OHM FIELD..... 2.98
8 IN. 4 OHM FIELD..... 2.98
6 x 9 IN. 4 OHM FIELD..... 2.98

KING SIZE MAGNETS

5" 8 oz. Alnico 3 magnet speaker, net....$1.79
8" 12 oz. Alnico 3 magnet speaker, net.... 2.98
10" 20 oz. Alnico 3 magnet speaker, net.... 4.95
12" 20 oz. Alnico 3 magnet speaker, net.... 5.95

5000 Famous Magnavox permanent magnet Alnico 3 speakers. We are offering these first quality speakers to you, practically at manufacturers prices. These are latest 1948 production. All are guaranteed to be perfect; no rubbing cones.

McGEE RADIO COMPANY

ORDER FROM THIS AD PRICES F.O.B., K.C.

SEND 25% DEPOSIT—BALANCE C.O.D.
1225 McGEE ST., KANSAS CITY, MISSOURI

RADIO TUBES

250,000 TO SELL. DEALERS ORDER AT THESE LOW PRICES.
Every tube guaranteed.

100 CARTONED and GUARANTEED RADIO TUBES *for only* $35.00

Popular GT tubes. All individually cartoned and branded Hy-Vac. Guaranteed best quality. Full replacement. These tubes meet the ever-growing need for low-cost service replacement and counter sales. Over 800,000 sold. A scoop item for the service dealer.

117P7 GT	6A7	3V4	35L6 GT	5Y3 GT
32L7 GT	47	6C5	35Z5 GT	6K6 GT
12A8 GT	12F5 GT	12SA7 GT	50L6 GT	6Q7 GT
12K7 GT	6S8 GT	12SK7 GT	6K7 GT	6V6 GT
25Z6 GT	6P5 GT	12SQ7 GT	6A8 GT	6X5 GT

39c EACH IN SMALLER QUANTITIES

6SA7 GT	117Z3	1L4	12A6	6BA6
6SD7 GT	12AT6	1U4	12SF7	6BE6
6SK7 GT	12BA6	1R5	6F5	6AT6
6SN7 GT	12BE6	1S5	6J5	6X4
6SQ7 GT	35W4	3Q4	6SJ7	6BJ6
25L6 GT	35B5	3S4	12SJ7	6AK5
7017 GT	50B5	1B4	6AJ5	6BH6
117L7 GT	1T4	12K8	6SF5	80

49¢ EACH FOR 75% OF YOUR RADIO TUBE NEEDS

BETTER BUY THOSE 12, 50 & 35 VOLT TUBES NOW BEFORE PRICES RAISE

EVERY TUBE GUARANTEED STANDARD BRAND—CARTONED AND UNCARTONED

12AH7	6K7	6SL7	12SG7	12SQ7
27	9001	6SN7	12SH7	12SR7
26	9002	6SG7	12SJ7	50L6
78	9003	6SR7	12SA7	12SK7
76	1625	6V6 GT	12SL7	25L6 GT
3S4	6SA7	6X5 GT	12SC7	35L6 GT
5U4G	6SC7	6AB7	1T4	35Z5 GT
5Y3G	6SF7	12AT6	1R5	35W4
6AC7	6SQ7	12BA6	1S5	50B5
6C5	6SH7	12BE6	6R7	2525
6H6	6SJ7	12H6	6L7	2526
6J5	6SK7	12J5 GT	7Z4	

50,000 GENUINE LOCTAL TUBES

49¢ EACH 100 FOR $45.00

GUARANTEED—MANUFACTURERS 1ST LINE

35A5	14Q7	7E7	7A7	7Z4
50A5	14B6	7H7	7F7	7Y4
35Y4	14C7	7C7	7N7	1201
14A7	7E5	7B6	7C5	

The above loctal tubes were made by the originator of loctals. 1st grade and guaranteed, full replacement. A purchase of 50,000 enables us to offer these $2.20 list tubes to you for only 49c each; $45.00 per hundred.

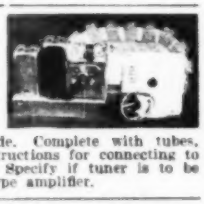
6L6 METAL TUBES 49c

New metal WAA 6L6 tubes. Good except are rusty due to storage in a damp place. 49c each, 10 for $4.50.

12SG7, WAA metals, good, but rusty, 19c each, 10 for $1.50.

First line metal OZ4. This is a hot value at only 69c, 10 for $6.50.

6L6 metal glass or popular GA, while they last $1.09, 10 for $10.00.



SUPERHET BROADCAST TUNER for connection to phono amp. or P.A. system. Compact chassis 5x3½x3 inches. May be mounted inside the record player cabinet. Requires only three connections to amplifier. Uses 6SA7 or 12SA7; 6SK7 or 12SK7 and crystal diode. Complete with tubes, loop antenna, dial and instructions for connecting to any amplifier. Net $7.95. Specify if tuner is to be used with AC or AC-DC type amplifier.

1948 MODEL—MIKE-BROADCASTER ONLY $7.95

Broadcasts 800 to 1500 KC from either a phonograph pick-up or a crystal or dynamic mike. Makes any radio receiver a P.A. system, record player or recording amplifier. Gives broadcast quality. Has fader control from mike to record, simulating a regular broadcast station. This is a powerful model; using 2-35L6, 12SJ7 and 35Z5 tubes. Priced with tubes and connecting instructions. Works on 110 volts AC-DC. Crystal mike and desk stand $4.95 extra. Model DE-5 truly a de-luxe mike-phono oscillator.

3-TUBE PHONO. OSC. ONLY $4.95

Model DE-4—Phonograph oscillator. Broadcasts from 800 to 1500 KC. Gain for any crystal pick-up. A new powerful circuit is used to assure plenty of power. Has variable gain control for proper modulation. Priced with tubes ready to operate, two 50B5 and 34W4.

Model DE-4 Net.....$4.95

Manufacturers Type Tubes
HYTRON & TUNG-SOL
PER CARTON OF 100 TUBES $45.00
No Broken Cartons

Guaranteed first line manufacturer tubes Tungsol or Hytron in factory packages, 100 to the carton. These tubes list at $1.65. Figure the saving at a discount of better than 60-10-10-and 10, actually less than present day manufacturers cost. Sorry, these tubes are sold in cartons of 100 of each type only. If you want less than 100 of one number use list of 49c tubes shown above. Net price on these tubes, 100 for $45.00.

12SA7, 12SK7, 12SQ7, 35Z5, 35L6, 50L6, 6SA7, 6SK7, 6SQ7, 6V6.

Tungar Bulbs—2 amp for battery charger. Scoop $1.95
1N34 Crystal Diode with full leads. Scoop price, 99c

GENUINE GENERAL ELECTRIC YGS-3 FM-AM SIGNAL GEN.

$195.00 VALUE FOR ONLY $99.50

General Electric Signal Generator Type YGS-3. For FM and AM servicing. An RF oscillator with fundamental frequency range of 100 kc. to 150 mc. An FM oscillator with center frequencies of 1, 20 and 50 mc's, and frequency deviations of plus or minus 20, 300 and 750 kc., respectively. A 1 megacycle crystal calibrator and variable-frequency audio oscillator. These four units may be used independently or in any logical combination by switching the front panel controls. Tube complement: 4-6AK6, 1-6AG5, 1-6SL7, 1-6AF6, 1-6SN7, 1-6J6, 1-9006 and 1-5Y3. Scoop price regular $195.00 YGS-3 Signal Generator, Net $99.50.

POPULAR 1½ VOLT LOCTALS

59c each 10 for $5.50

Guaranteed 1½ volt loctal tubes, regular $2.65 list, now offered at the ridiculous price of only 59c each, 10 for $5.50.

1LN5 1LD5 1LH4 1LC6 1LA6 3LE4

Manufacturers Type Octal 1½ V. Tubes 59c ea.

Guaranteed top quality 1½ volt tubes at a big saving.

1N5 1H5 1A7 1A5 3Q5

ELECTRIC BLOWER HAIR DRYER

$5.95

Handy Hannah Blower driven hair dryer. Twin switches and diaphram control. An indispensable item for every home. Scoop price $5.95.

G.E. VARIABLE RELUCTANCE PICK-UP AND PRE-AMP $6.95

Scoop—Pre-amplifier for General Electric Variable Reluctance pick-up. Easily connected to any AC or AC-DC amplifier. Wired and Tested with 6SC7 or (12SC7) tube. Diagram for connections is furnished. Specify whether you want pre-amplifier for AC or AC-DC use. Net price, Pre-amp. with Tube and G. E. Pick-up—$6.95.

WHEN ORDERING—Send 25% deposit, with C.O.D. orders. Send full remittance with order less than $5.00. On parcel post orders, include ample postage. Any extra amount will be refunded.

McGEE RADIO COMPANY

ORDER FROM THIS AD PRICES F.O.B. K. C.

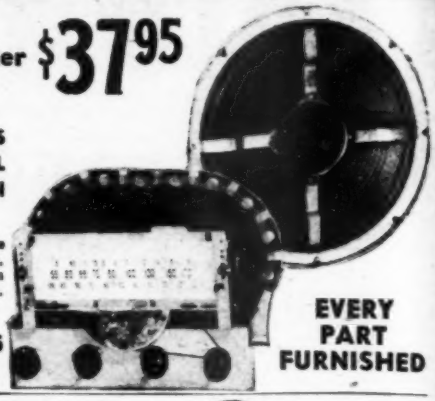
SEND 25% DEPOSIT—BALANCE C.O.D.
1225 McGEE ST., KANSAS CITY, MISSOURI

BUILD THIS HIGH FIDELITY RADIO

8-TUBES—12" Coaxial Speaker $37.95

A COMBINED 2-BAND RADIO & 15 WATT P.A. SYSTEM

- 8-INCH SLIDE RULE DIAL
- PUSH PULL OUTPUT TUBES
- EVERY THING FURNISHED
- RECEIVES BROADCAST AND 19 to 49 METERS
- BASS BOOST TONE CONTROL
- CHASSIS SIZE 9½ x 11 x 8" HIGH
- BEST RADIO KIT VALUE IN THE WORLD



EVERY PART FURNISHED

Here is something new in radio. A real 15 watt power amplifier with bass and treble controls. Has extra gain stage for crystal or dynamic mikes. And on the same chassis, a standard superhet radio receiver. We furnish all parts, knobs, escutcheon plate and tubes: 6SA7, 6SK7, 6SR7, 6SN7, 6SJ7, two 6V6 and 5Y3. No cabinet. Extra care in designing the power supply section assures low hum level, making this unit ideal for recording as well as P.A. use. We furnish everything as well as schematic diagram and photos of the completed chassis. Weight 35 lbs.

PRK-24 Radio-Amp. Kit with 12" P.M. speaker. With tubes .....Net **$29.95**

CPR-15. Exactly the same kit as the PRK-24 kit, except it is furnished with a 12" Cinaudagraph wide range speaker. (Has built-in high frequency tweeter.) This is our finest kit.....Net **$37.95**

NATIONALLY FAMOUS GAROD PERSONAL RADIO

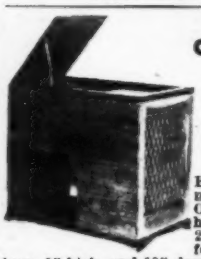
KIT Complete with Batteries $14.95

Size: 6½"x 3¼"x 4⅛" — Weighs Only 3½ Lbs.

- Two-Tone Ivory, Red Plastic Cab.
- 4-Tube Superhet
- Two-Gang Cond., Lucite Dial
- Loop Aerial, Built-in Lid
- AVC.
- Looks like and is a Commercial Radio Kit
- Simple Assembly and Wiring Instructions

This kit is ready for immediate delivery. The same nationally known factory that manufactures tens of thousands of this radio, is line-producing this radio kit for us. Every part, from the cabinet down to the last resistor, is matched. The chassis is ready punched; all you do, is mount the parts and wire. This radio kit will assemble into a beautiful personal radio for you, just the same as it does for the factory. We furnish you a diagram, photograph of the completed chassis and full assembly instructions so that those with a minimum knowledge of radio may wire this kit. The beautiful case is made of metal with plastic hinged lid and snap-on back. The lucite face of the receiver has an inlaid gold design. The circuit is the conventional two gang superhet type, with A.V.C. Receives the broadcast band, 540 to 1650 KC. Uses miniature tubes: 1R5 converter, 1S5 detector A.V.C., 1T4 amplifier and 3S4 power amplifier. Alnico V PM speaker. The loop antenna is built in the lid. Radio comes on automatically when lid opens. Operates on self-contained batteries. Priced complete with tubes and 67½ volt "B" battery and flash cell (Not AC-DC). Nothing else to buy. **Model X-45. Price $14.95.** Include Postage for 6 lbs.

SCOOP MODEL X-45 PERSONAL PORTABLE KIT WIRED AND TESTED WITH BATTERIES. NET $17.95



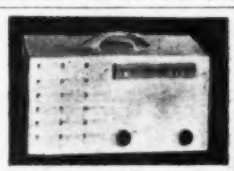
WALNUT ARM CHAIR CABINET

$29.95

WILL HOUSE CRP-15 KIT

Beautifully made walnut armchair cabinet. Outside dimensions 24" high, 16½" deep and 27" wide. Ample room for radio receiver 14" long, 9" high, and 10" deep. Will hold a changer up to 14" square. Will accommodate speaker up to 12". Has record album storage compartment. Hinged lid covers changer compartment. Cabinet AR-15. Net price **$29.95.** General Instrument changer **$14.95,** extra. Armchair cabinet in blonde finish. Net price **$34.95.**

4-TUBE BATTERY PORTABLE KIT $10.95



Portable Kit Model KP-Y. Housed in a leatherette case 12" x 7" x 7". Easy to build. Operated on self-contained B and A batteries. Receives broadcast 550 to 1600 kc. Incorporates a standard superhet circuit with AVC. Has 5" Alnico V PM speaker. Priced complete with batteries, schematic diagram and tubes 1R5, 1S5, 1T4, and 3S4. Not AC-DC, but straight battery operated. Has 2 gang condenser. Everyone should have one of these personal portables. Everything furnished. Kit KP-Y Net price **$10.95.**

BUILD A RADIO Like you would buy 5-TUBE KIT ONLY $9.95

Made from Detrola Components

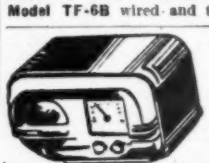
A full size 5 tube superhet radio kit housed in a 13 inch wood cabinet with full plastic front. Lighted slide rule dial. Incorporates a standard 2 gang superhet circuit. Loop antenna, ready punched chassis, etc. This is another one of our fine production radio kits. Every part is furnished including tubes. 14Q7, 14B6, 14A7, 50B5 and 35Y4. Diagrams, photos and instructions are included. 5" dynamic speaker. Receives broadcast 550 to 1650 kc. Weight 9 lbs. **Kit model TF-5B.** Net **$9.95.**

Model TF-6B wired and tested. Net **$12.95.**

DELUXE 3-WAY PORTABLE KIT $16.95

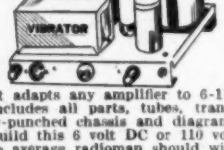
Model 3-ZB, 3-way portable kit. Has 4 tubes plus selenium rectifier. Complete with 300 hour battery pack and beautiful leatherette covered case 12" x 10" x 7". Build this powerful 3-way portable kit. Operates on 110 volts AC or DC or on self-contained battery pack. Receives broadcast 550 to 1600 kc. Incorporates a standard superhet circuit with AVC and loop antenna. Has 5" Alnico V PM speaker, 2 gang condenser. All parts and battery pack are furnished, including tubes. Disc rectifier, 1R5, 1S5, 1T4, and 3S4. Shipping weight 14 lbs. Net price kit model 3-ZB, **$16.95.**

4 TUBE RADIO KIT $6.95



4 tube AC-DC, TRF radio kit. Ideal for students and beginners. Every part furnished to build this kit, including tubes, diagram and photos. Has Alnico V PM speaker and tubes 12SK7, 12SJ7, 50H5 and 35W4. Plastic cabinet with airplane dial. Receives broadcast 550 to 1600 KC. This is the easiest type of radio to build. Kit Model TF-4 Net **$6.95.** Weight 6 lbs.

6-110 VOLT POWER SUPPLY KIT MAKES ANY AMP. WORK ON A STORAGE BATTERY $14.95



New Power Supply Kit adapts any amplifier to 6-110 volt operation. Kit includes all parts, tubes, transformer, vibrator, ready-punched chassis and diagrams necessary for you to build this 6 volt DC or 110 volt AC power supply. The average radioman should wire this unit in an hour or less. Supply furnishes from 110 volts 60 cycle, 350 volts DC at 135 mills, 6.3 volts AC. Also, from 6 volts DC it produces 110 volts 60 cycle AC to run a phono motor, record changer, or small AC-DC radio; 350 volts DC at 135 Mills. Instructions are furnished, to show you how this supply can be adapted to make any P.A. systems, up to 25 watts, operates on 6 volts DC or 110 volts AC. Switching is done in the power supply. Everything complete, including 2-6X5 rectifiers. Kit 6-110KR. Net **$14.95.** Spare heavy duty vibrator, **$1.95** extra.

6-110 volt amplifier kit. A companion unit to the power supply kit above. Utilizing PP 6L6 output tubes, unimatch transformer, inputs for microphone and phono pick-up. Kit includes 6-110KR unit shown above. Kit model 22-KR, net price **$29.95.**

TOOLS FOR THE BUILDER

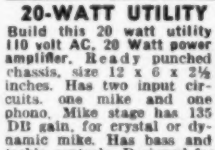
Ungar soldering pencil	$1.49
80 watt soldering iron	2.49
100 watt soldering iron	3.29
1 lb. spool Kester resin solder	.99
5 inch Krauter long nose or diagonal cutters, each	1.49
Supreme publication radio service course book	2.50

INTER COM KITS $7.95

Inter-com kit. All parts furnished to build a small two-way call system (Master and one sub-station speaker). Has 3" speaker and tubes 70L7 and 12SL7. Has separate 3" speaker for sub-station. Ready punched chassis. Everything complete, less cabinet. Diagrams and photo furnished. **Kit TB-3.**

12 WATT AMPLIFIER KIT, $10.95

Push Pull 6V6's Gain for Mike



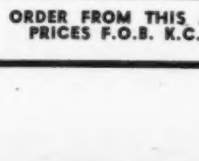
KIT MODEL AC-12. 12 watt amplifier kit. Ideal for high quality record player as well as public address or recording amplifier. Matched component parts, ready punched chassis pan. One control fades from phono to microphone. Gain enough for crystal or dynamic microphone. 100 mil power transformer, for 110 volt AC 60 cycle operation. Priced complete with tubes: 2—6V6, 6SN7, 6SH7 and rectifier. Diagrams and photos furnished. Kit AC-12. Net **$10.95.** 12" Alnico 5 PM speaker **$6.95** extra; crystal microphone and desk stand **$4.95** extra.

The above AC-12 amplifier wired and tested ready to operate net **$14.95.** Specify Stock No. AC-1125. 12-inch Alnico V PM speaker **$5.95** extra. Crystal mike and desk stand **$4.95.**

20-WATT UTILITY AMP. KIT, $17.95

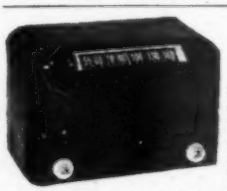
Build this 20 watt utility 110 volt AC, 20 Watt power amplifier. Ready punched chassis, size 12 x 6 x 2½ inches. Has two input circuits, one mike and one phono. Mike stage has 135 DB gain, for crystal or dynamic mike. Has bass and trebie controls. Designed for use with PM speakers; has 8-16 ohm output transformer. All parts and easy-to-follow diagram furnished, including tubes: 2—6SN7, 6J5. 2—6L6GA, 5Z3. Kit Model 20-LX.....Net **$17.95**

POWERFUL SINGLE RECORD PLAYER Z-26.



Housed in an attractive leatherette covered cabinet. Latest 78 RPM rim drive motor and light weight pick-up. Ready wired and tested 70L7 type tube amplifier. Tone and volume control, 5" PM speaker (Alnico V). This kit easily slips together. Priced complete with tubes and hook-up instructions. Kit Z-26.....Net **$9.95**

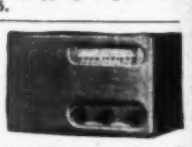
1949 MODEL AC-DC KIT $12.95



This is our latest and finest AC-DC radio kit. Receives Broadcast, 540 to 1650 KC. Has full length illuminated slide rule dial. Choice of Ivory or Walnut plastic cabinet. Full high efficiency 3 gang superhet circuit, with loop antenna. Ready punched chassis, full 5" PM speaker. Every part fits. Everything furnished, including tubes, 12SA7, 12SK7, 12SQ7, 35Z5 and 50L6. This kit will go together just like it would on the production line. Diagram, photos and instructions are furnished. Shipping weight 9 lbs. Kit model XA-49. Net **$12.95.**

AMERICAN AND FOREIGN KIT $14.95

550 to 1600 KC and 6 to 18 MC



This radio kit is housed in an attractive grey opalescent finished metal cabinet. Incorporates a standard 2 gang superhet circuit. Receives Broadcast (550 to 1600 KC) and foreign short wave (6 to 18 Megacycles). This kit is complete, nothing else to buy; just as all our kits. Ready-punched chassis. It will go together just as it would down a production line. Has full 5" PM speaker. Complete with tubes: 12SA7, 12SK7, 12SQ7, 35Z5, 50L6. Diagram, photos and instructions are furnished. Shipping weight 10 lbs. Kit model DT-5. Net **$14.95.**

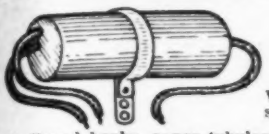
McGEE RADIO COMPANY

ORDER FROM THIS AD PRICES F.O.B. K.C.

SEND 25% DEPOSIT—BALANCE C. O. D. 1225 McGEE ST., KANSAS CITY, MISSOURI

BIG SALE! ONE MILLION "FAMOUS BRAND" CONDENSERS

SAVE UP TO 75%—ALL FRESH STOCK—ALL GUARANTEED ONE YEAR



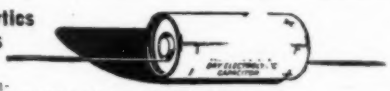
Tubular Replacement Elec. Manufacturer's Type

We sell these every day by the hundreds. A small physical size, guaranteed for one year.

Cardboard banks, paper tubulars, manufacturer's type.

20-20 150v cond.	$0.29	50-30-20 150v cond.	$0.49
20-20-20 150v cond.	.35	50-30 150v, 25 25v cond.	.49
40-40 mfd 150v	.39	10-10-10 400v cond.	.49
50-30 150v cond.	.39		

Single Tubular Electrolytics in Metal Sealed Tubes



One year guaranteed. 1st line manufacturer. Aluminum tubes, with insulating sleeve. Lowest prices.

25 mfd 25v	$0.19	8 mfd 450v	$0.29
30 mfd 150v	.29	16 mfd 450v	.39
40 mfd 150v	.39	30 mfd 450v	.49

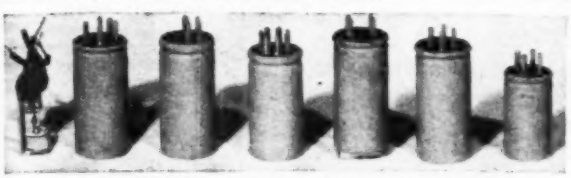
ALL-FRESH ONE YEAR GUARANTEE

FABRICATED PLATE ELECTROLYTICS

Popular Twist Mounting

These popular F.P. Aluminum can electrolytics are the twist type mounting. Cans are small size 1" x 2" and 1" x 3" and 1¼" x 2½". Made by Solar etc. Guaranteed first line, fresh manufacturer's type. More capacity in a smaller space, with these.

10 mfd. 450v FP condenser	$0.29
20 mfd. 450v FP condenser	.39
40 mfd. 450v FP condenser	.49
10-10 mfd 450v FP condenser	.49
10-10-10 mfd 450v FP cond.	.49
30-15-30 450v, 25-25v FP cond.	.69
30-30 350v, 25-25v FP cond.	.39
25-25 25v FP condenser	.19
40-20 150v FP condenser	.39
40-20 150v 100-25v FP cond.	.49
40-40 150v, 40-40 25v FP cond.	.49
50-30 150v 20-50v, 100-10v FP	.59



EVERYDAY NEEDS IN 6 VOLT VIBRATORS

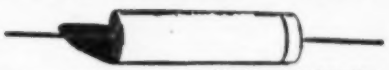
Every Vibrator Guaranteed—Best Vibrator Values in U. S.

Replacement sync vibrator unit	$0.99
Standard 5 prong sync vibrator	1.49
6 prong reversible sync vibrator	1.99
7 prong reversible sync vibrator	1.99
7 prong, 2 volt G.E. vibrator	1.99
4 prong, off-set Delco vibrator	1.49
5 prong sync vibrator	1.49
4 prong vibrator for Ford	1.49

SOLAR

C. D. AEROVOX AND SPRAGUE ALL 600-VOLT STANDARD BRANDS

AT LESS THAN JOBBER COST



All these tubular condensers are first run and of nationally known manufacture. Branded and rated 600 working volts. These prices are down to earth. Better order a hundred assorted. You can't go wrong.

.001	$0.06	.02	$0.06
.002	.06	.05	.07
.005	.06	.1	.08
.01	.06		

BUY 100 ASSORTED FOR $6.95

Buffer condensers 1600 volts .001, .005, .008, .01, .02 17c each, 10 for $1.50

EQUIPMENT TYPE BYPASSES

Popular sizes of famous brand equipment type 400 volt rated tubular condensers. C.D., Solar or equal. Ideal for replacements in AC-DC sets, etc. We sell these to our dealers by the hundred for $5.00.

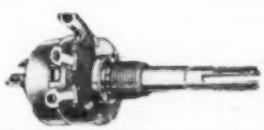
.01 400 volt, .05 400 volt, .1 400 volt 6c each; 100 for $5.00; .25 400 volt 10c; .5 400 volt 12c

Small diameter vinlon cover mike cable. Sale price 4c per foot.
Belden heavy duty mike cable. Best ever made 6c per foot, 100 ft. for $4.95.
Turner crystal.

SOLAR WET ELECTROLYTICS

Genuine Solar Screw Mounting Wet Electrolytics. Latest 1948 production. Use Solar wets when you want a filter for those tough jobs.

8 mfd. 500 volt Wet	$0.78
16 mfd. 500 volt Wet	1.15
20 mfd. 500 volt Wet	1.23
8 mfd. 600 volt Wet	1.23
16 mfd. 600 volt Wet	1.64



VOLUME CONTROLS

Unbeatable Values

If you are now paying $1.08 for a volume control with switch, look these values over. Our stock is obtained direct from the manufacturer. Every control guaranteed. No need to pay more than our price for good controls.

Regular manufacturers type with 2⅛" shaft that is split and knurled. These controls fit 90% of all radio sets.

500,000 ohm with SPST switch	39c	10 for	$3.50
500,000 ohm with DPST switch	39c	10 for	3.50
1 megohm midget with SPST switch	39c	10 for	3.50
500,000 ohm less switch	29c	10 for	2.50
1 megohm midget, less switch	29c	10 for	2.50

Regular 3" shaft jobbers stock controls at scoop prices.

500,000 ohm with DPST switch for battery radio sets and portable	49c ea.,	10 for	4.50
1 megohm tapper, with SPST switch	45c ea.,	10 for	4.50

Newest molded 600 volt condensers. The best there is. High temperature plastic construction; moisture resistant. Made by a renowned builder of condensers whose name you are familiar with. Save over half on these sizes.

SAVE 50% FAMOUS-BRAND 600V. PLASTICS

.001, .002, .005, .01, .02, 10c each; .05, 11c each; .1 mfd 12c each

STROMBERG-CARLSON F.M. Trombone Ant

$4.95 EACH — 3 FOR $14.00

Super value. Folded Di-pole antenna, for FM and Television. Complete with 60 feet of twin 300 ohm line and 4 low-loss stand-off insulators. This folded di-pole covers frequencies 42 through 108 megacycles. Trombone action makes exact tuning to any one weak station. Furnished with adjustable mounting bracket. Has 5 foot mast. Made for Stromberg-Carlson. Stock No. Mt-300—Net $4.95. Weight 4 lbs. Individually packed.

VIBRATOR SCOOP!

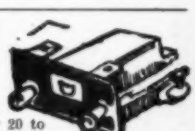
99c Each — 10 For $8.95

Standard size 4 prong vibrator made for uncle. Brand new. Has 8 contact for those standard or heavy drain car sets. Equal to vibrators of $4.50 list. Regular size can. This is the hottest value in a 4 prong non-sync vibrator in the U. S. Dealers and servicemen, order a good supply now!

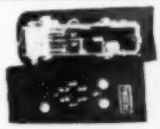
MALLORY 4-PRONG $1.29

Genuine 4 prong, 6 volt Mallory vibrator. 8 point, non-sync. A scoop at only $1.29 each, 10 for $11.00.

UNIVERSAL UNDER DASH CONTROLS $3.98



Attractive Under Dash Remote Control with choice of drive ratios, 8, 10, 12, 16, or 20 to 1. To find the ratio that you need, count the turns from min. to max. of the condenser gang and double. Specify ratio when ordering. If on-off switch in remote control, add $1.00 to the price.



Heavy Duty Vibrator — Made for 6-110 volt amplifiers. Freq. 60 CPS. Scoop price $1.99
135 ma 6-110 volt conventional power transformer, with all windings; will run phono motor. $5.95
(Use with above vibrator)

SHURE MIKE $5.95

Shure crystal desk mike and stand. Head is detachable and will fit standard floor stand. A $10.00 value for only $5.95
Stock No. SS-T
Net Price $5.95

AMERICAN D4-T MIKE $10.95 SCOOP

1st line high impedance dynamic mike. A $15.00 value, furnished with 20' mike cable, Net Price $9.95

CRYSTAL HAND MIKE $2.98

Turner crystal hand mike, with 10' mike cable. No provision for mounting. Ideal to have in the shop as a test crystal mike.

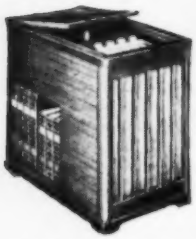
SHURE MIKE $10.95

Shure CX-50 Crystal mike, with 20' of cable. A full size mike worth 50% more than our price, Net Price $10.95

McGEE RADIO COMPANY ORDER FROM THIS AD PRICES F.O.B. K. C. SEND 25% DEPOSIT — BALANCE C. O. D. 1225 McGEE ST., KANSAS CITY, MISSOURI

IT'S McGEE'S FOR RADIO SETS

AM—FM—SHORT WAVE
Custom Chassis



LESS THAN DEALER COST ON THIS WELL KNOWN GAROD ARMCHAIR RADIO-PHONO COMBINATION

NET $89.50

6 Tube Chairside, 2 band automatic radio phonograph combination. Changer plays 10 12" or 12 10" records. Transformer type AC chassis receives broadcast 540 to 1650 kc and shortwave 5.7 to 18.5 mc. Hand rubbed mahogany piano finish. Cabinet has record storage compartment 24" x 16" x 27". Scoop price Garod Model 6DCP2 **$89.50.** Only a few to sell.

GAROD AM-FM—$129.50

Beautiful Blond Cabinet

The Garod 11FMP-9 is for those who demand the best in AM-FM reception and automatic record playing. Housed in a beautiful blond cabinet, highly polished and second to none in quality. Size 34x27x16". Has record compartment, two post automatic changer in a slide away drawer on the left. Has 11 tubes and twin speakers. Receives broadcast 540 to 1650kc, shortwave 5.3 to 18.5 mc and 88 to 108 mc FM. This radio is made to sell for $259.00. Only 25 to sell. Here is your chance to get a radio as beautiful and as fine as was ever built. Better order yours today. Net price **$129.50.**

STATUE-RADIO $26.95

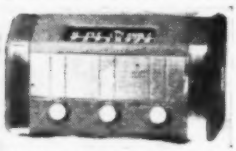
Bronze Horse With 5-Tube Radio in Base

Globe Model 559 Statue-Radio. An artistic achievement in design. An authentic reproduction of a horse, in gleaming bronze. Mounted on a dark mahogany base containing the powerful AC-DC superhet radio Tunes broadcast 540 to 1620kc. Full 5 tubes, with Alnico V PM speaker. Height 13½ inches. Net Price **$26.95.** 3 for $24.95.

COIN OPERATED RADIO SETS—ONLY $24.95 EACH

RCA

Licensed



OPERATES TWO HOURS FOR 25c AMERICAN & FOREIGN BANDS BRAND NEW 6 TUBES A $60.00 VALUE

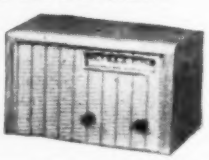
Model No. M1-131174. Coin Operated Radio. The Sensation of the year. 6 tube, 2 band, American and Foreign shortwave. Gray metal case, trimmed with chrome. Made by America's largest manufacturers, R.C.A. licensed. Start your own money making business. Finance through your local bank and put in Hotels and Tourist Cabins, in your community. You can buy this fine radio unit for about one-half the price the largest operators in the nation have paid for them, the last two years. Has 25c slot, set to play for two hours. This radio has out-sold all other coin operated sets. Even this fine AC chassis is worth more than our price for the whole radio. It is especially made to be easy to service. Don't miss on this. You can have your own business, with 100 of these radios located near your home and they will bring you profit for years to come. Remember, they won't last long at this price. Net Price in single lots, **$24.95,** 5 for **$110.00.** Write for 100 lot price.

3-WAY PORTABLE $16.95

Dynavox. A small personal 3-way portable radio. A full superhet circuit 4 tubes plus rectifier. Housed in an attractive leatherette case. Has hinged lid. An exceptional value at only **$16.95**

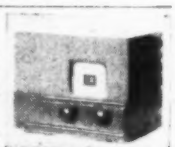
Requires 67½ B and flash lite cells for A.

DETROLA 5-TUBE AC-DC $12.95



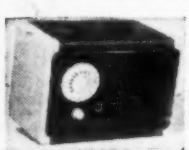
Detrola Model 571. Attractive Blond Wood Cabinet AC-DC radio, with plastic grill front. Size 12x7⅝x8". Covers broadcast band, 540 to 1600kc. Has 5" dynamic speaker. Uses tubes 12SA7, 12SK7, 12SQ7, 50L6 and 35Z5. Loop antenna. Brand new in factory cartons.

FM-TUNER



Top quality FM tuner for 88 to 108 MC. This is a ratio detector type. A full superhet, not a regenerative gadget. This one works or your money back. Stock No. FR-88.
Net Price $20.49

MECK 3-WAY PERSONAL PORTABLE $19.95



Model 5D-7 Broadcast superhet (550 to 1650 KC) Personal portable; only 5x6x8 inches. A big radio in a small package. Operates on 110 volt AC-DC or self-contained batteries. Has 4 miniature tubes and disc rectifier. Uses 2 45 volt 455 Eveready B batteries and 5 flashlight cells. Net.....$21.95
In lots of 3.....**$19.95**
Kit of batteries $2.69—Extra weight 10 lbs.

Service Bench Chassis Holder—Reg. $5.00 Net $1.95

100 Mil Selenium Rectifier 59c

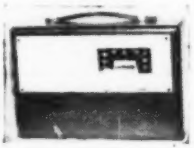
2-Watt Neon 110v. Base 39c

COMPLETE DISC RECORDER $39.95

78 RPM Disc Recorder. The best value in America, today. Makes records from mike or radio. Has beautiful tan case, leatherette covered. Size 8x13x16 inches. 78 RPM, R-70L General Industries record playback mechanism and wired and tested recording amplifier (Push-pull 50L6 output, 4 tubes plus rectifier), 5 inch Alnico V PM speaker. You get all material for recorder; nothing else to buy. Only a few minutes time required to mount the amplifier, R-70L and speaker in the case. A $70.00 value with easy to follow instructions. Net Price **$39.95.**

This recorder offered as single speed (78 RPM) only. The case will not accommodate the dual speed mechanism. 33 1/3 RPM is not successful on this type of unit. Model CRR-1.

OUR LEADER Full Size 3-Way PORTABLE RADIO $19.95



Full size 3-way portable radio. Operates on self contained 300 hour bat. or 110 volt AC-DC. Has 4 tubes plus disc rectifier. A full superhet circuit. Attractive tan leatherette case. Made to sell for **$39.95** our price only $22.95, weight 10 lb. Made by Nationally known mfg. 7½-9. 90 pack bat. $2.95.

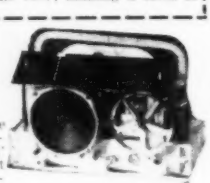
MONTHLY SPECIAL

GAROD 9-TUBE AM-FM CHASSIS WITH 12" SPEAKER $59.95

McGee's monthly special. Garod 9 tube broadcast and FM chassis. Powerful transformer type. Twin lited plastic dial. Full 12 in. dynamic speaker. This is not a cheaply built chassis but a full grown radio. The same chassis is incorporated in receivers selling for **$300.00.** Why not install this in your old cabinet.
Compact construction makes this chassis adaptable to most all console or chairside cabinets. Stock No. LA-91 net with tubes and 12 in. speaker. **$59.95.**

Booster amplifier with 2 6L6 tubes and its own power supply for the above Garod Chassis. $20.00 extra. This gives added audio power for those who desire push-pull amplification. A 5" speaker is furnished along with the 12" for extended H. F. response. If you want a 15" Cinaudagraph PM speaker, in place of the 12" speaker, add $10.00 to the cost; making a total of **$89.95.**

RCA 6-TUBE 2-Band Radio Chassis $16.95 5 for $79.50



Attention foreign buyers. Here is a hot chassis value. Genuine RCA, 6 tube AC-DC chassis. Receives broadcast and 19 to 49 meters, shortwave. Has built in loop with 6" slide rule dial 5" speaker. Priced complete with tubes, 12SG7, 12SA7, 12SK7, 12SQ7, 35L6, and 35Z5. Brand new in factory cartons. Stock No. RCA 6. Shipping weight 14 lbs. Net price **$16.95** each. 5 for **$79.50.**

OUR LEADER PORTABLE RADIO RECORDER $89.50

Our leader AC radio and Dual speed recorder. Another leading value in the electronic field. We bought them right and are passing on our buying power to you. This unit has a standard AC, power transformer type, broadcast receiver and recording amplifier. Has General Industries dual speed recorder and playback mechanism, and microphone. A red hot value. Model VT-41. Net **$89.50.**

Peewee 3-Way Personal Air King $19.95

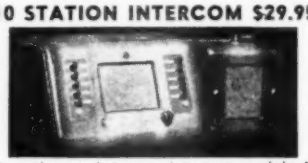
Air King 3-way portable radio, Model A-520. Polystyrene cabinet in maroon with contrasting grill, recessed easy-to-read dials. Superhet, 4 tubes plus selenium rectifier, built in loop antenna. Weighs only 4 lbs. with batteries. Size 8¼x5x4". Model A-520. Net Price **$19.95.** Kit of batteries $1.55, extra.

Square and Round Chassis Hole Cutters

Round sizes ½, ⅝, 1⅛, ⅞ and ⅞". Net price.....$1.95
Round sizes 1". Net price 2.15
Round sizes 1⅛, 1¼, 1⅜, 1-11/64, 1⅝ and 1¾. Net price $2.30
Round sizes 1⅞". Net price 2.65
Square sizes ⅝". Net price.....$2.95
Square sizes ¾". Net price..... 3.50

R.C.A. Two-Station Intercom. It has Amplifier made separate, to reduce size of stations; housed in plastic case, trimmed with chroma. Low distortion produces natural voice reproduction. Ease of installation makes this unit ideal for home, office or store. Complete with amplifier, two stations and 100 ft. wire....$49.95

10 STATION INTERCOM $29.95



This 10 station push-button inter-com. originally cost the dealer over $40.00. Attractive walnut finished cabinet; made by East coast manufacturer. With tubes 14F7, 50L6 and 35Z5. Master and one sub-station, net **$29.95.** Extra sub **$5.95** each.

G.I. RECORDER MECHANISMS

Latest 1947 General Industries recording assemblies with 4 ohm magnetic cutters and crystal play back.
Model R70-L—78 RPM. Net **$24.50**
Model R90-L—33 and 78 RPM. Net..... **26.95**
Model R130-L—Automatic changer with cutter, 78 RPM. Net..... **40.10**

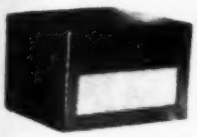
McGEE RADIO COMPANY

WRITE FOR CATALOG PRICES F.O.B. K.C.

SEND 25% DEPOSIT—BALANCE C.O.D.
1225 McGEE ST., KANSAS CITY, MISSOURI

COMPLETE PORTABLE WIRE RECORDER $69.95

With Webster Chicago Mechanism



Portable Wire Recorder Model GN-11. Has ready wired and tested 5 tube AC type amplifier with push-pull 6V6 tubes. Built-in eraser circuit. Input for crystal mike or phono pickup. Diagrams show how you can record from any radio receiver. 3 position switch enables you to quickly change from record to playback or conventonal P. A. system. This amp delivers 12 watts of good clean audio. Here is what you get: Webster 79 recording mechanism, with 15 minute spool of wire, attractive leatherette covered case, 6" heavy duty PM speaker and wired and tested 12 watt AC wire recording amplifier. All you do is mount the amp, recording mechanism and speaker. Simple instructions furnished. Portable Recorder Model GN-11 Net **$69.95.** Crystal mike $4.95 extra.

DELUXE MODEL GN-12 $79.95

Deluxe Portable Wire Recorder Model GN-12. Has same features as the model GN-11, as well as a larger split leatherette covered case and a heavy duty 10 inch PM speaker. Deluxe Wire Recorder Model GN-12. Net **$79.95.** Crystal mike $4.95 extra. Recording Wire. 15 minute spool $1.30, 30 minute spool $1.95, 1 hour spool $3.25.

WEBSTER 79 Wire Recording Mechanism $44.10

WEBSTER 79 WIRE RECORDER, PLAY BACK MECHANISM. Wiring diagram of necessary amplifier included with kit. The entire mechanism is a completely assembled unit. Weight 10 pounds. Includes one fifteen minute spool of recording wire. This is the hottest new item in the electronic field. Webster 79 recording mechanism. Net **$44.10**: Extra recording wire, fifteen minutes $1.30; thirty minutes $1.95; one hour $3.25.

Air King Recorder Mechanism $44.95

Air King Wire Recorder Foundation Kit, as used in the model 750 wire recorder. Comes complete for playing 10 or 12 inch records. Size 9x13 inches; 7 inches overall height, 2½ inches above mounting board. Furnished with oscillator coil, diagram for building recording amplifier and 15 minute spool of recording wire.

8 In. Coaxial P.M. $6.95

8" Heavy Duty PM speaker, with 2" tweeter. This coaxial arrangement has its own hi-pass filter. Makes one of the best sounding speakers ever built. Stock No. 1045. Net Price **$6.95.**

Children's Player Kit $7.95

New, children's electronic player. Offered in kit form. Includes all material necessary. Attractive red plywood cabinet, self-starting phono motor and crystal pickup, 4x6" PM speaker and parts to build 70L7 amplifier. Diagram included. Stock No. 1J-1. Net Price **$7.95.**

Portable Player Kit Scoop $9.95

Deluxe portable electronic record player kit. Includes all parts and easy to wire diagram. Comes complete with grey leatherette portable carrying case self-starting phono motor, pickup, 5" PM speaker and all necessary parts to build 70L7 amplifier. Stock No. CK-1. Net Price **$9.95.**

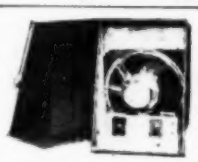
RECORD PLAYER $13.95

Complete record player. Component parts shipped separately. Amplifier is ready wired and tested. Amplifier has three tubes, 12SQ7, 35Z5, 50L6. All parts are included, self-starting phono motor, crystal pickup, 5" heavy duty PM speaker and amplifier, with tone and volume control. Deluxe heavy wooden case is covered with brown leatherette and has chrome fittings and speaker grill. Stock No. CC-2. Net Price **$13.95.**

Deluxe Record Player $19.95

Our Deluxe portable record player, with a ready wired and tested push-pull 7C5, 4 tube amplifier, with tone and volume control. All parts are included, self-starting phono motor, heavy duty 5" PM speaker, crystal pickup and beautiful two-tone brown leatherette covered case, sturdily constructed of heavy plywood. Only a few minutes time is required to slip this unit together. Stock No. DL-3. Net Price **$19.95.**

PORTABLE P.A. $39.95



18 watt complete portable public address system. Has inputs for a crystal or dynamic mike and phono pickup. Has push-pull 7C5 tubes in output. Attractive leatherette covered split type case. Priced complete with two 10" PM speakers. This is a complete public address system wired ready to play. Stock No. RC-18. Net **$39.95.** Priced complete with crystal mike and desk stand

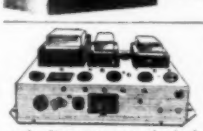
Amplifier chassis only with tubes, less speaker, case and mike; in kit form. Diagram furnished. Stock No. AC-18 Net $10.95. AC-18 amplifier wired and tested. Net $14.95.

8-WATT AMPLIFIER WITH P.P. 50B5 $9.95

4 tube, plus rectifier, AC-DC amplifier. Push-pull 50B5 output tubes, with 12SJ7 (Gain for mike or G.E. variable reluctance pickup), 12SL7 (Gain for conventional crystal pick-up) and phase invertor. This is a nice small audio amplifier, with tone and fader control, plus inverse feed-back. Furnished wired and tested, complete with tubes. 8 watts output. Ready to play. Weight 6 lbs. Model TM-5. Net price $9.95. Crystal mike and desk stand $4.95 extra. 8" PM speaker $2.95 extra. G.E. variable reluctance pick-up cartridge $4.69 extra.

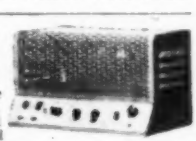
PAGING AMP. $16.95

Here is a complete low power P.A. or Paging system, utilizing the TM-5 amplifier described above. Housed in a leatherette covered portable case, with 8" heavy duty speaker. Model N-T5. Net Price **$16.95.** Crystal mike and stand $4.95, extra.



Juke box amplifier surplus. All the necessary parts to build a juke box amplifier. Jumbo power transformer and output. This is a late model with two 6L6 output tubes. All necessary parts and diagram are included. Stock No. KV-7. Net Price **$24.95.** with tubes, 12" Alnico V PM speaker $5.95, extra.

High Fidelity 30 Watt Amp. Kit $29.95



Kit model RA-30. Complete 30 watt 6L6 power amplifier. Beautiful ready punched chassis, with perforated metal cover. Inputs for 2 mikes and crystal or variable reluctance pickup. All parts are provided, including a husky output transformer and power transformer. All small parts and diagram furnished complete with tubes; 6SJ7, 6SJ7, 6C5, 6C5, 2-6L6, and 5Z3 or equivalent. Nothing else to buy. This kit will make an amplifier you will be proud of. Worth twice our purchase price. Model RA-30, weight 35 lbs. Net Price **$29.95.**

MASCO AMP. SALE

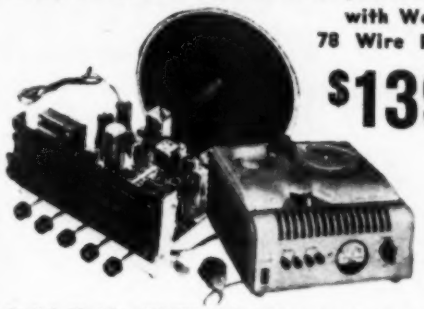
35 Watt with Auto Chgr. $79.50

Masco Amplifier Model MA-35 RC. A powerful 35 watt amplifier (110v AC) with automatic record changer, built on top. Has inputs for two mikes and phono pickup. Unimatch output transformer. Two 6L6 tubes in output. Made to sell to the dealer for $100.00. A few left. Sale Price **$79.50**, complete with tubes. Masco Amplifier Model MA-25P. (110v AC) A 25 watt amplifier, with single phono motor and pickup built-in top. Inputs for two mikes and phono pickup. Two 6L6 tubes in output, with unimatch output transformer. Sale Price **$49.50.**

CAPITOL 13-TUBE AM/FM RADIO

with Webster 78 Wire Recorder

$139.50



Capitol 13 tube AM-FM high fidelity chassis. Receives broadcast and FM, 88 to 108 mc. Beautiful slide rule dial. Bass boost tone control. Push-pull 6V6 tubes give high audio fidelity. 12" heavy duty Alnico V PM speaker. And with this chassis a Webster 78 wire recording unit. With these you can make top quality wire recordings from the mike or from any AM or FM radio station. The unique push button arrangement on the wire recorder makes you able to change from radio record to playback quickly. Recordings are played back through the radio's high fidelity audio system. This is without a doubt the most material ever offered for $139.50. Stock No. CWX-12. Net **$139.50.** With 15" Cinaudagraph PM speaker. Net Price **$144.50.**

AIR KING Portable Wire Recorder

- **Plays and Records on Wire from Records or Mike**

A-725 Air King wire recorder. Comes complete with mike ready to record on wire from mike or records. Unique mechanism allows records to be played or recorded. Contains an amplifier housed in an attractive leatherette covered case. One of the best wire recorder values. Weight 40 lbs. A-725. Net Price **$69.50.**

NET $69.50

ALTEC LANSING AMP. KIT

10576 Kit $54.00 **603-B $63.00**

"For the romantic breed, who are never satisified until they build their own."

Altec Lansing 10576 Amplifier kit. The Altec Lansing 10576 15 watt amplifier kit contains all the special parts to construct the famous Altec A-323B amplifier. This is the amplifier, especially designed for the highest quality reproduction of music, which has astounded the musical world with its simplicity of connection, exceptional ability to deliver power over a wide range of frequencies, and freedom from hum, noise, harmonics and intermodulation distortion. The A-323B amplifier has built into it all the gain and the proper equalization for the new magnetic phono pickup cartridges such as the General Electric and Pickering. No pre-amplifier or gadgets are required. The Altec Lansing 10576 amplifier kit contains the following parts: Output transformer, power transformer, low pass equalizer choke, punched and painted chassis, chrome escutcheon plate, schematic and pictorial diagram and resistor-capacitor mounting board. All other parts, such as tubes, sockets, resistors, capacitors, switches, wire, etc., are standard and readily available.

By purchasing the A-323B in kit form, a considerable saving in cost may be effected. Assembly requires only a few hours and is both simple and informative.

The completed amplifier has a phono input gain of 117 db and radio input gain of 77 db. Frequency response 20 to 20,000 cycles plus 1 db. Continuously variable 6 db bass boost at about 75 cycles from flat bass response. High frequency equalization is 4 position low pass filter which allows either flat, high frequency response or sharp cut-off at 8 kc, 6 kc, or 4 kc. This system gives sharp cut-off of noise yet allows full reproduction of useful high frequencies and is quite different from usual resistor-capacitor treble tone control. Amplifier has phono input with gain and proper equalization for variable reluctance phono cartridges. Has three output impedances: 2.5 to 5, 8 to 12 and 16 to 24 ohms. Tubes required are 2-6J7, 1-6J5, 2-L6G and 1-5U4G. The dimensions are 9"x12"x9". Shipping weight 15 lbs. Altec Lansing 10576 kit less tubes. Net price **$54.00.** Model A-323B Altec Lansing amplifier complete as pictured above with tubes **$133.00.** Speaker recommended: Altec 603-B Net **$63.00.**

15" Altec Lansing 603B Multi-Cell Dicone is a completely new type PM speaker. Rated at 25 watts with a 3" 8 ohm voice coil. The metal high frequency diaphragm operates into a multicellular horn. Frequency division is accomplished mechanically. Weight 20 lbs. Net Price **$63.00.**

RADIO DEALERS—SAVE ON ALL RADIO AND ELECTRONIC EQUIPMENT AT McGEE

PHONO PICKUPS-CARTRIDGES-CHANGERS-MOTORS

BIG SAVINGS on CARTRIDGES

Astatic MLP-1 cartridge used in Webster Chicago and many other original equipment changers, with needles **$1.49**

Astatic MLP-2 improvement over the MLP-1. Has quiet type QT needle, no surface noise. Scoop price **$1.95**

Standard L-40, L-26, cartridges, old standbys, thousands in use. Complete with rest clip. Each, **$1.49**

Astatic L-70, L-75, cartridges. Each, **$1.49**

Astatic L-72A 3½ volt output, used in one lung record players, etc. Also where tone networks are used. **$1.49**, 10 for **$13.00**

NJ-1 Nylon cartridge with permanent, but changeable needle. **$3.29**

RCA magic-tone cell, with permanent sapphire needle. Modernization kit replaces 95% of old cartridges in RCA radio phonographs, built during 1938 and later. 4 page instruction book included. A scoop at only **$1.95**

General Electric
VARIABLE RELUCTANCE CARTRIDGES
$3.95

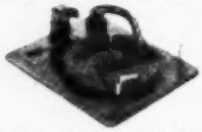
Genuine G.E. Variable Reluctance pickup with permanent needle; with jewel. This unit has been publicized so much, nothing need be said. Scoop price **$3.95**

CALTRON VARIABLE RELUCTANCE CARTRIDGES
$2.95

Genuine Caltron Variable Reluctance pickup cartridge, with permanent needle. Mounts in as easy as the G.E. Use in many professional arms. As used in recording and studio work. Very Special Net price **$2.95**

CRYSTAL PICKUPS ON SALE

Plastic arm Webster, light weight, normal output Sale price $1.49.
Astatic L-70 curved arm pickup $1.95.
Shure glider, normal output pickup $1.95.
Astatic O-7 straight arm off-set head pickup $1.95.



SENSATIONAL SALE
On Popular Changers

Seeberg Intermix **$29.95**

Triple Post Seeberg Intermix changer. The best value in America today	$29.95
Aero Single post changer, base size 12 x 13" Permanent needles, net	14.95
General Instrument, single post changer, base size 11 x 12", the best	14.95
Farnsworth changer, 2 post with variable reluctance cartridge, net..	19.95
VM-200 twin post changer a scoop at only	13.95
VM-400 twin post changer, inter-mix 10 and 12" records, sale price..	19.95

Individually designed leatherette covered bases for any of the above listed changers, each, $1.95.

PHONO NEEDLES

Juke Box Needle. Long playing, 12 for	$ 2.39
Duo-tone 99 Sapphire needle 59c, 10 for	4.95
Duo-tone Nylon $2.50 list needle. Net Price	1.25
Webster Chicago Nylon Ossium point needle 10 for	12.50
Webster Chicago Nylon Sapphire tip needle 10 for	17.50
Duo-tone Stellite cutting needle each	1.20

VOLT-OHM-METER
$29.95

Jackson Model 643, new condition, push-button type Volt-Ohm-Meter. 1000 ohms per volt sensitivity. Measures volts AC or DC to 1000 in 5 steps. Ohms, low, medium and high ranges. 3 mil scales. A scoop at only $29.95.

Hammarlund Hq-129 receivers. Only six of these to sell, at less than our cost. All new and factory cartoned. Rush your order. Only the first six orders can be honored. Scoop price $129.50. Also, only one Super Pro. Net **$249.50**

GET YOUR GLASSES AND LOOK THESE OVER

40 ft. No. 16 Leadin, rubber covered and stranded. Special 19c
I.C.A. Universal AC-DC line cords. $1.00 value. Special 49c
8 ft. G.E. AC line cord and plastic coated plug.... 24c
10 for $2.00
6½ ft. G.E. AC line cord and plastic bakelite plug. 16c
10 for $1.50
2 gang condenser, 2 I.F.'s, loop, and oscillator coil, matched. Special $1.29
Finest 456 I.F. transformers. Matched. You can't beat this. Each 49c
Pee Wee Iron Core 456 I.F.'s. A hot value. Each.. 39c
10 watt wire wound resistors, all sizes 19c
25 watt wire wound resistors, all sizes 25c
67½ volt "B" wafer cell, best quality $1.39
5 for 6.50
High grade Grill Cloth, brown or grey, 48" wide, 1yd.. $1.49
Spagetti tubing, ⅛" bandle ass'td 9" long. Special. 19c
3 or 4 wire oscillator coils, 456 special 15c
Bronze dial cable, as used on old sets. Spec. 100 ft.. 99c
2 watt Neon lamp. Standard base, 35c value, spec.. 19c
10 for $1.50
Hi-impedance Army head phones. Civilian type band and cord, special $1.49
Loop antennas. Small, medium and large. All late production. Special 29c
38/62 Solder. Made by Division Lead Co. Good quality. Special 49c
50 MA. AC-DC chokes..... 39c, 75 MA..... 59c
50L6 output transformers, 3Q5 outputs. 39c, 10 for $3.50
4 watt universal output transformers 75c
8 watt universal output transformers 95c
12 watt universal output transformers $1.25
60 MA Stancor flush-mounting 6.3v, 5v transformers, for 5 and 6 tube sets $1.49
60MA Uprite transformers 6.3v, 5v transformers, special $1.95
Filament transformer, 1 amp, 6.3 volts, special 99c
4 mfd. metal case C.D. oil-filled condenser 600v. Spec.. 39c
New Astatic curved arm pickup, less cartridge and base, special 29c
Large 3 heat switch as used in electric stoves, spec.. 39c
350 MA 6 Henry 82 ohm choke, insulated to 2500 volts, special $1.95
10 boxed General and Stancor transformers, chokes for older sets. You can't lose, or we will refund your money. Special $2.95
Phono-combination, 5 tube AC-DC radio chassis and automatic changer in good walnut cabinet. Shipped in separate pieces, 15 minutes to assemble. Net. $29.95
10" wall baffle, Walnut. Special $2.95
Walnut blank cabinets, 14" long, 8" high, 7" deep. Will hold most mantle sets. Special price $2.95.
40-44-46-47 G.E. and Westinghouse panel lamps. 10 for ..... 49c, 100 for $4.50
Permeability tuners, band type. Can't backlash. by Electronic Lab. Special 99c
Ballantine 78 RPM rim-drive phono motor, with turntable. Special $2.95

TIME SWITCH $4.95

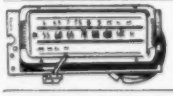
Self-starting Electric Clock; with built in TIME SWITCH. Turns radio or appliance off or on at any pre-set time. Use your radio as an alarm clock.
Scoop Price $4.95

Electric Clock
$7.95

Numechron Direct Reading, self-starting clock. A real timepiece. Plastic rosewood case, size 10"x4"x4". Wholesale price $7.95. Retailers must collect federal luxury tax.

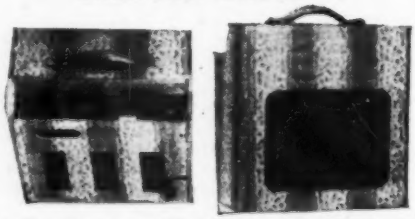
UNDER DASH AUTO RADIO
$50.00 Value—$31.50

Universal Underdash, 6 tube Auto Radio, with RF stage. Iron core I.F. transformers, new miniature tubes. Size 5½"x 4⅛"x12⅛". Has 5" speaker. Easy to fit any car. Wt. 9½ lbs. Net price **$31.50**



8" SLIDE RULE DIAL $2.49
Esc. Plate; Etc., Furnished

$59.50 VALUE MUSICAL AMPLIFIER WHILE THEY LAST $24.95



8 watt musical amplifier, 4 tube AC type. Inputs for crystal or dynamic mike and phono or instrument pickup. 2 gain controls and tone control. Has heavy duty built-in 8" speaker. Attractive leatherette covered case. Made by a large manufacture to sell at $59.95. Brand new, fully guaranteed. For 110 volt AC operation. Our scoop price, $24.95. Stock No. XR-3. Contact instrument pick-up, $6.95 extra. Deluxe instrument pick-up; with volume control, $8.95 extra. Crystal mike and desk stand $4.95. Shipping weight, 30 lbs.

3-TUBE MUSICAL AMP. $19.95

In same deluxe case as the model XR-3 shown above. Has same features except it is designed for instrument pickup only. No input for mike. Stock No. XR-32. Net $19.95.

G. I. RM-4
$5.95

G. I. RM-4 Heavy duty phono recording motor, with turntable ..... A scoop at	$5.95
Deluxe 78 RPM rim-drive phono motor with turntable ..... Special	2.95
Standard 78 RPM. phono motor, with turntable. ..... Special	1.95
Replacement motors for 90% of all automatic record changers ..... $1.49, 2 for	2.79

Brand New

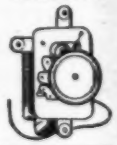
ELECTRONIC MEGAPHONE
SCOOP PRICE
$34.95

Only 100 of these Brand New Electronic Megaphones to sell. You may see these listed at a lower price, but ours are new and guaranteed to work. Amplifier straps on shoulder, then just hold megaphone and speak into mike, mounted on rear of projector. Pull switch to turn on dry battery operated amplifier.

67½ volt 'B' battery, for personal portable radios. Branded Marvel. Fresh stock. Make extra cash with these. We have sold 2,000 already. Guaranteed. **$1.39**, 5 for $6.50.

You May Need This Motor Tomorrow

Phono Motor for Record Changers. Fits 75% of all changers built. Rated about 1/100 horsepower. 110 volt 60 cycle. Ideal for experimenters, etc. **$1.49** each, 2 for $2.79.



MULTI-PARTS DRAWERS
12 for $4.41

Here is what you have been looking for. Parts bin drawers. Each bin 2¾" x 2¼" x 5" deep. Ample space for condensers, resistors and small parts. They interlock on all sides, into a sturdy unit. Order as many as you will need. Net 40c, each, 12 for $4.41.

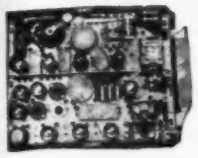
McGEE RADIO COMPANY

ORDER FROM THIS AD
PRICES F.O.B. K.C.

SEND 25% DEPOSIT—BALANCE C.O.D.
1225 McGEE ST., KANSAS CITY, MISSOURI

15-TUBE CIVILIAN BAND TRANS-RECEIVER $7.95

GENERAL ELECTRIC BC-645A



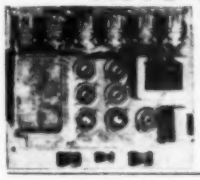
450 MEGACYCLE TRANS-RECEIVER
With Citizen Band-Conversion Schematic

1000 TO SELL AT LESS THAN THE WORTH OF THE TUBES BRAND NEW

A small complete Transmitter and superhet receiver, for the 450 megacycle band. Diagrams for building AC power supply and conversion furnished. Ideal for MCW, CW or phone. The tubes (4-7F7, 4-7H7, 2-7E6, 2-6F6, 2-955 and WE-316A) are worth more than our sale price. BC-645 I.F.F. unit $9.95 each. Two for $19.00. Extra WE-316A tube 99c. 12 volt DC dynamotor (furnished all power) $2.95. BC-645 shipping weight 25 lbs.

BC-645A $7.95 EACH TWO FOR $15.00

AUTO PILOT, SALVAGE SCOOP



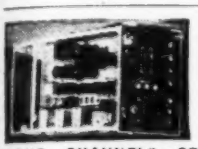
$1.49 EACH TWO FOR $2.49

HAS 6 HIGH RESISTANCE RELAYS

Auto pilot amplifier salvage scoop. Has 6 high resistance relays that operate in tube plate circuits on less than 8 mills. Also 4 controls. Choke cond., etc. Less tubes. Used but in good condition. Weight 12 lbs. Stock No. C-1T. Net $1.49; two for $2.49.

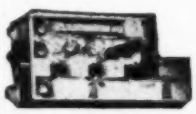
SCR-518 RADIO ALTIMETER, $24.95
Complete, New, with 29 Tubes

Famous SCR 518 A Altimeter. Brand new factory cartoned. Worth over $900.00. Made by RCA. Complete as pictured. Has 29 tubes. Works in the 500 MC region. This is the complete unit. Transmitter, receiver, power supply and 3" scope indicator. Reads altitude up to 30,000 ft. Operates on 28 volts, D. C. Complete with tubes. 6SK7, 2 8012, 2 6SJ7, 6C8, 6SN7, 6F8, 23D4, 6V6, 10 6AC7, 3 2X2, 954, 955, 956, 6J5 and 3 in. CR tube 1808P. A RED hot scoop at only $24.95 complete. Weight 70 lbs.



2-METER TRANS-REC. ARC-4 $12.95

FOUR CHANNELS CRYSTAL CONTROLLED. ARC-4 for VHF frequencies 140 to 144 megacycles. There are 7 tubes in the transmitter: 832, two 1614, two 6V6 and two 6L6. The receiver section has 13 tubes: two 6AC7, four 6N7, three 12SJ7, two 12SQ7 and two 12A6. The unit is actually two receivers and one transmitter in one piece. One receiver is for standby use. Has built on dynamotor for 24 volt DC operation. Priced complete with tubes and four crystals and dynamotor. Hams convert this for two meter operation. It's a scoop at this price. Used, but good condition. Weight 30 lbs.



SCOOP 110 Megacycle Rec. .733D $6.95

BC-733 D Localizer Receiver

Freq. 108-110 Mc; Tube complement; 10 tubes—1—12SQ7, 2—12SR7, 1—12A6, 1—AH7GJ, 2—12SG7, 3—717A. Now only $6.95
BRAND NEW. A RED HOT VALUE.

AM-61 INDICATOR AMPLIFIER Has 15-Tubes A SCOOP at Only $9.95

BRAND NEW

AM 61A Indicator Amplifier. Brand new factory cartoned. Has 28 volt DC Blower motor and fan. 2 2mfd 1000 volt cond. 2 2X .5 mfd. 1000 volt cond. and many other parts. Complete with 15 tubes, 7 6SN7, 3 VR 105, 5Y3, 3 6SL7, 8016. As a salvage item this is a RED Hot Buy. The tubes are worth more than our price. Weight 30 lbs. Net $9.95.

CRYSTAL CALIBRATOR For Collins Auto Tune, etc.

$100 LESS TUBES

3 tube crystal calibrator; gives 50 KC beat notes for transmitter dial calibration. Requires 200 KC crystal and 2-12SL7 and 12SA7 tubes. A handy item to have. The coils are worth more than our sale price. Wt. 4 lbs. A scoop price for $1.00.

CATHODE RAY TUBES

5BP4 White Screen.	$2.95
9LP7	2.95
7BP7	2.95
5FP7	2.95

PACKARD BELL Pre Amp $1.00

BRAND NEW

Brand New Packard Bell re-amplifier, with tubes 6SL7 and 28D7. In handy size case 5" x 4" x 7". With instruction book. Weight 4 lbs. A scoop at only $1.00.

BC-1206 $4.95

BRAND NEW RECEIVER 195 TO 420 KC

Designed to receive A-N beam signals. 24-28 vdc. Tube complement: 14H7, 14A7, RF, 14H7, 14J7, 14A7, 14H7, IF amplifier; 14R7, detector and 1st audio; 28D7, output, 195 to 420 KC 4" high x 4" wide x 6⅝" long. Weight 4 lbs.

NAVY-GLIDE PATH $1.00

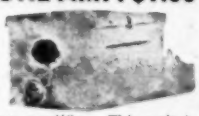
Salvage SCOOP BRAND NEW

Navy Model ZA Glide Path Receiver. Requires 3-6C6 tubes. A real salvage scoop. Transformer, controls and handy aluminum case, 6" x 7" x 12". All in good condition. Weight 7 lbs. Scoop price $1.00.

INTERPHONE AMP. $1.00

ONLY 250 TO SELL

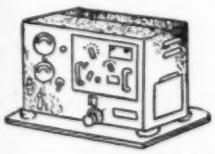
Brand New



AM 26 interphone amplifier. This unit is nice for parts salvage and the aluminum case is usable for receiver building etc. Size 9⅛x4½x5". Has two transformers, four tube sockets, three filter condensers, three position panel switch, toggle switch, and many small parts. All are in perfect condition.

SCOOP

IF THERE EVER WAS ONE 250 ONLY BC-223 BRAND NEW TRANSMITTERS $3.95



Brand new BC-223 army transmitters for phone or CW. Requires 3-46 and 2-801 tubes, which are readily available in war surplus. Shipped less plug-in tuning unit; that should be easy to get for a dollar or two. These transmitters are new in wood crates. The 2" 3 ampere RF current meter is worth our sale price. You should not pass up this transmitter scoop; even to tear up for parts, its a buy. Only 100 to sell. Shipping weight 65 lbs.

3" SELSYN INDICATOR
Works on 16 to 25v. 60 cycle

$2.45 EACH Two for $4.45

CARBON HAND MIKE, 89c

Army carbon hand mike with push-to-talk switch, cord and plug. Brand new and factory cartoned. While they last. 89c each; two for $1.59; ten for $6.50.

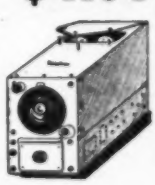
PULSE FORMING NETWORKS

Used in small radar modulators, available in three sizes, 67 ohms impedance, 7.5 Kilowatt rating.
H-603, one micro second, 200 pulses per second..$1.00
H-601, three micro seconds, 200 pulses per second.. 2.00
H-602, 16 micro seconds, 60 pulses per second..... 3.00

80 METER COMMAND REC. $4.95

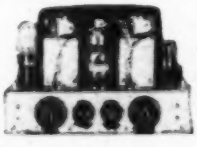
BRAND NEW 454—3 TO 6 M.C. REC., $4.95

We have a few of the popular 80 meter 3 to 6 mc command receivers in factory cartons. Brand new complete with all 6 tubes. Better place your order now. Weight 8 lbs. New BC-454 $4.95, each.



BRAND NEW 458 TRANSMITTER, $5.95

NEW BC-456 MODULATORS $2.49 A SCOOP



Brand new modulators with tubes, VR-150, 12J5 and 1625. Built for the BC-457 and BC-458 command transmitters. Less dynamotor $2.49. Used BC-456 modulator with tubes and 28 volt dynamotor $2.95.

Only a few hundred brand new BC-458 5-7 mc command transmitters, complete with tubes, to sell at $5.95 each. Weight 11 lbs. A few BC-457 4-5.3 new go at $5.95 each.
Used command triple receiver rack with shock mounting .99 each.
Used command twin transmitter rack with shock mounting .99 each.

SALVAGE RECEIVERS $1.79

Scoop. We have a few hundred BC-453, 454, 455 less tubes; used and cases bent, but still good for parts. Sorry, no choice of frequencies. $1.79 each.

NEW APN-1 ALTIMETER....$9.95

APN-1 Radio Altimeter. A complete transmitter and receiver in one package; for the 420 megacycle region. These units are new and in perfect condition; complete with tubes VR-150, 5-12SH7, 2-12SH7, 2-12H6. Only 100 to sell. Instructions are available for a few units. Weight 25 lbs.

R.D.F. RECEIVER $19.50

MN-26C Compass receiver. Brand new factory cartoned. This unit covers from 150 to 1500 kc., inclusive; in three bands. Complete with eleven tubes of the 6 volt type 6SA7, 6SK7, 6F6, etc. Has a 28 volt dynamotor built in. This unit does not have a dial included. MN-26C Net price $19.95. Only a few available.

WHEN ORDERING—Send 25% deposit, with C.O.D. orders. Send full remittance with order less than $5.00. On parcel post orders, include ample postage. Any extra amount will be refunded.

McGEE RADIO COMPANY

ORDER FROM THIS AD PRICES F.O.B. K. C.

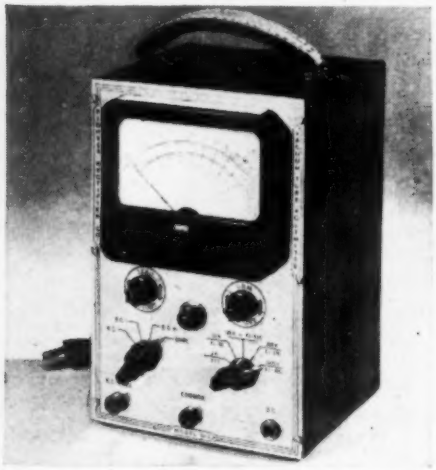
SEND 25% DEPOSIT—BALANCE C.O.D.
1225 McGEE ST., KANSAS CITY, MISSOURI

What's New in Radio

RADIO KITS' V.T.V.M.

A high frequency v.t.v.m. in kit form is currently being marketed by *Radio Kits Company* of New York.

The new kit features a linear diode a.c. rectifier and 1% precision resistance for improved high frequency



measurements. The output meter scale is calibrated for a 600 ohm circuit based on a reference level of 1 milliwatt.

The v.t.v.m. measures up to 1000 volts a.c. or d.c. on a 5 range linear scale and up to 1000 megohms in 5 ranges. The kit comes complete with tubes and assembly instructions.

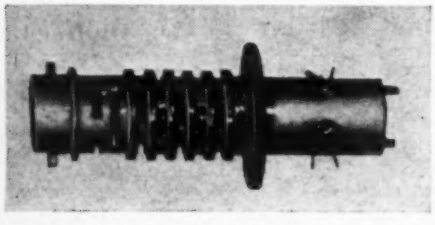
For further information write *Radio Kits Company,* 120 Cedar Street, New York, New York.

COMPONENT LINE

Super Electric Products Corp. of Jersey City, New Jersey, is in production on a line of precision components for the electronic industry.

Of particular interest are the company's high voltage power supply and power supply coil for television applications.

The high voltage power supply unit comes in two models, the SP70 rated at 7000 volts d.c. and the SP90 rated at 9000 volts d.c. Specifications on the



SP70 include a full-load output power of 5 watts, maximum output current of 800 microamperes, full-load, no-load regulation of approximately 13 percent, plate supply voltage 300-315 volts d.c., plate supply current of approximately 60 ma., operating frequency of approximately 280 kc. and a tube complement of one 6V6GT and one 1B3GT/8016. The SP90 has a full-load output power of 8 watts, a maximum output current of 1000 microamperes, approximately 15 per-cent full-load, no-load regulation, 85 ma. plate supply current with 360-375 volts d.c. plate supply voltage, and an operating frequency of approximately 280 kc. The tube complement is the same as for the SP70.

The power supply coil, the Model SPG 10 has a maximum secondary r.f. peak voltage of 10,000 volts, a maximum secondary rectified current of 1000 microamperes, and a maximum rectified power output of 10 watts.

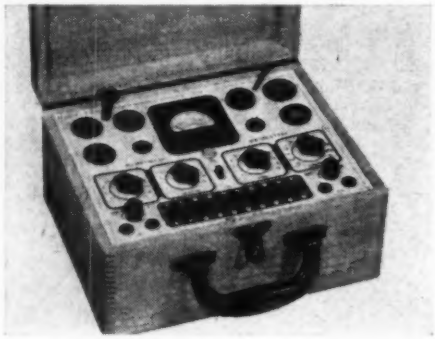
For complete data on these components write to *Super Electric Products Corp.,* 1057 Summit Avenue, Jersey City 7, New Jersey.

TUBE AND SET TESTER

Test-Craft Instrument Co. of New York City has announced the new Model TC-50 tube and set tester.

This all-purpose test unit combines seven instruments; a d.c. voltmeter, an a.c. voltmeter, a d.c. milliammeter, an ohmmeter, output meter, decibel meter, and tube tester. Full scale accuracy to 2% is claimed for the instrument. A "Good" and "Bad" scale is provided for the tube testing function.

The Model TC-50 operates on 90-120 volt, 60 cycle a.c. It is housed in a



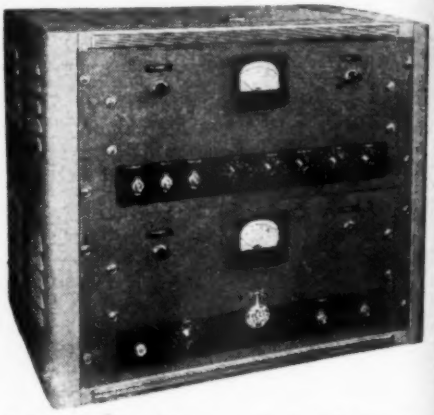
portable cabinet and comes complete with test leads, tube charts, and detailed operating instruction. The cabinet measures 8" by 10½" by 5".

A data sheet covering the Model TC-50 is available on request from *Test-Craft Instrument Co.,* 42 Warren Street, New York 7, New York.

150 WATT XMTR

World Radio Laboratories of Council Bluffs, Iowa, is currently featuring a new amateur transmitter which provides 150 watts input on phone and c.w. on the 10, 11, 15, 20, 40, and 80 meter bands.

The tube line-up of the r.f. section includes a 7C5 crystal oscillator, a 2E26 buffer, a TZ40 final amplifier, with VR150's as voltage regulators, 5R4GY rectifier, and a 5U4 tube rectifier for the power supply which is mounted on the same chassis. The modulator in this transmitter consists of a 6SJ7 into a 6N7 phase inverter into a pair of 6F6's as triodes into a pair of 6L6's operating Class B. The modu-



lator also has its power supply on the same chassis.

Static plate current runs 8 ma. and when modulating runs up between 200 and 250 ma.

This transmitter is available in individual sections, as a completely wired unit, or in kit form. Complete detailed description is available on request. Write to *World Radio Laboratories,* 744 West Broadway, Council Bluffs, Iowa.

NEW "SNAP NUTS"

Prestole Corporation of Toledo is currently introducing a new spring steel, self-locking "Snap Nut" which is said to expedite the anchoring of nut-to-panel for blind attachments.

With the new unit no welding, riveting, clinching, or special tools are necessary. The nut is simply pressed into assembly position. It is attached directly from the work surface instead of the reverse side of the panel as is commonly done. It snaps into a 9/32 square hole in panels .037" to .005" thick and is designed for easy entrance of the screw even in cases of extreme misalignment of panels.

As the screw is driven, the arched spring arms of the nut expand just enough to permit entry of the screw, locking the fastener to the inner panel, and at the same time binding against the root of the screw thread. This new fastener will accommodate both No. 8 and No. 10 sheet metal screws, the larger size merely expanding the spring arms. The unit will withstand a tightening torque of 35 to 45 inch pounds.

According to the company, the nut is particularly suited for blind attachments on radios, automobiles, refrigerators, and other mass production products. Samples and further infor-

MORE HOURS OF SERVICE

MICROPHONE CABLES

Belden *Radio* **WIRE**

mation is obtainable from *Prestole Corporation*, 3153 Bellevue Road, Toledo 6, Ohio.

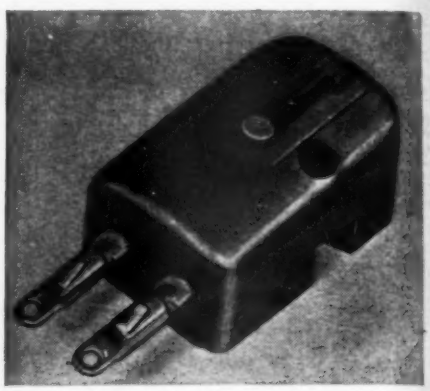
NEW G.E. CARTRIDGE

The Receiver Division of *General Electric Company's* Electronics Department has announced a new variable reluctance cartridge designed especially for the new long-playing Microgroove records.

The new cartridge, which features a low mass stylus assembly and high compliance for more faithful tracking, is one-third smaller than previous models. The new, improved shape of the cartridge makes it more universally adaptable to various tone arms. It also affords greater clearance for record changers.

The stylus of the new cartridge is a sapphire, measuring one mil in diameter as required for the new Microgroove recordings.

According to the company, all properties inherent in the previous *G.E.* variable reluctance cartridges are incorporated in this new unit. These include such features as negligible needle scratch and needle talk, minimum record wear, wide frequency response, and freedom from resonance peaks.



The Receiver Division of *General Electric Company's* Electronic Department is at Electronics Park, Syracuse, New York.

INDOOR TV ANTENNA

Marino Radio Co. of New York is currently in production on an indoor television antenna, the "Telebeam."

Designed for television, FM, and experimental work, this unit is said to be adaptable to all 12 channels and features an exclusive "swivel controlled action" at the base and a built-in tuning stub running parallel to the dipole support.

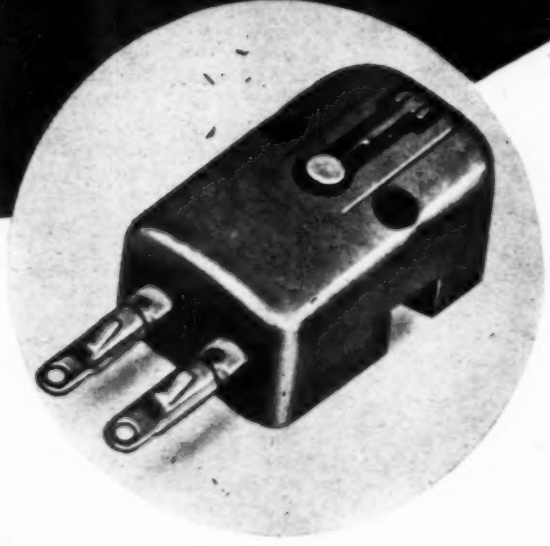
The set may be installed either on top of the television receiver or may be hooked to a window sill. A special felt underpadding prevents scratching when mounted on the receiver or other furniture.

According to the company, the easy-to-operate ring-tuned matching spring stub makes possible increased signal pickup and maximum energy transfer from the antenna to the receiver. The ring is operated either up or down the

(*Continued on page* 187)

It's here!

The NEW General Electric Variable Reluctance Cartridge for Long Playing Records



- Specifically designed for the new long playing records... high compliance... low mass stylus assembly
- Equipped with 1 mil tip radius sapphire stylus
- Can be used with standard G-E preamplifiers

Place your order today!

General Electric Company, Electronics Park, Syracuse, New York

You can put your confidence in—

GENERAL ELECTRIC

Screen Grid Modulation

(*Continued from page* 41)

these tests is shown in Fig. 1, (page 41).

Although a single 6V6 oscillator stage will drive an 813 sufficiently for c.w. operation, it was thought better to use an isolating buffer, both to avoid any chance of modulating the oscillator, and also to insure plenty of drive especially for 10 meter operation, so a 6V6 buffer-doubler was added.

Looking at the diagram, we have a 40 meter 6V6 tritet oscillator, doubling to 20 meters in the plate circuit, which, in turn, drives another 6V6 used as a buffer-doubler, whose plate output is tuned to 10 meters. For simplicity's sake, the 813 grid is capacity-coupled directly to the 6V6 plate. No fixed bias is used, as the plate voltage is fairly low and no harm will come to the tube if the final plate is not left off resonance indefinitely. The final plate tank circuit may be varied to suit the taste of the constructor. A single-ended condenser can be used if preferred. An r.f. choke in the plate lead may be required in some cases. A 300 to 400 volt supply may be connected at point "X" on the screen resistor, and the resistor omitted for better regulation of screen voltage.

Two stages of resistance-coupled speech give enough audio drive to the 6V6 modulator tube to sufficiently modulate the 813 screen, with the final plate loaded to full output.

In constructing a compact transmitter it is always necessary to keep the audio and radio frequency leads as short as possible, and to keep each section isolated from the other, or serious feedback, caused by radio frequency current getting into the audio fields, either by induction or by feeding through interconnecting wiring, will result. Where a common power supply is used for both the r.f. exciter and audio sections, it is sometimes necessary to use an r.f. choke with a bypass condenser, either side of it, in the "B plus" lead to the r.f. section.

For push-pull final amplifiers it is only necessary to tie the screens in parallel and tie the modulation transformer secondary in the common "B plus" lead that goes to both screens. The suggested speech and modulation equipment for such an arrangement, would, for crystal or dynamic microphone input, consist of a 6SJ7, resistance-coupled to a 6J5, which is resistance-coupled to a 6N7 phase inverter, which drives a pair of 6V6's. A 10 watt modulation transformer would still do very nicely up to 500 or 600 watts input to the final amplifier. For higher power operation up to a kilowatt, a 25 or 30 watt modulation transformer could be substituted for the 10 watt one mentioned previously and a pair of 6L6's with 300 volts on their plates and screens would be sufficient to handle it.

Since the original article was writ-

520 Sq. In. PICTURE

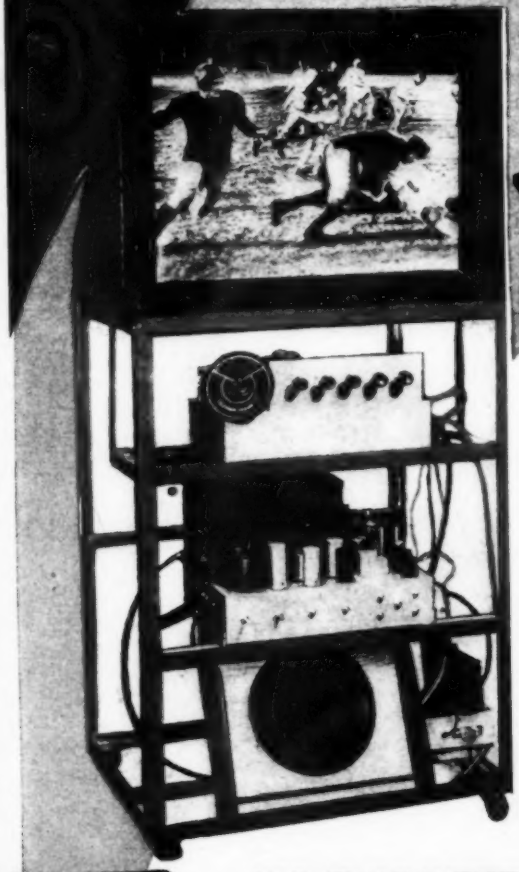
PROJECTION TELEVISION

IN ASSEMBLY FORM

COMPLETE WITH RACK

20 x 26" Screen

TELEVISION ASSEMBLY CO.



Bausch & Lomb f:1.9 Projection Lens

37 R.C.A. TUBES

DUMONT INPUTUNER

12" P.M. SPEAKER

Pre-wired & Pre-tuned Picture I.F. & Sound I.F.

Pre-wired 30 KV Tripler Fly Back Power Supply

Eastman Kodak Projection Screen

Aluminum Coated Top Mirror

AUTOMATIC GAIN CONTROL

EXPRESSLY DESIGNED
Metal Rack, Hood and Picture Frame

For realism, clarity, definition and **BIG SCREEN** Televiewing, the pictures produced by this unit have no equal!

This screen is absolutely flat, precluding curvature distortion anywhere in the picture. Picture tones are true black, grey and white—high in brilliance, yet absolutely glare-free!

MANUAL OF INSTRUCTIONS AND SCHEMATIC DATA

Prepared and Edited by
JOHN F. RIDER PUBLISHER, INC.

10"-
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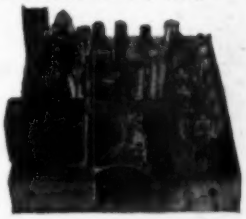

CABINETS

CABINETS for all Television Assembly Co. models are available. Details and prices furnished upon request.

DIRECT-VIEW TELEVISION

Both Champion and Standard Models are supplied with 13 tube Picture IF and Sound IF (Pat. Pend.) completely wired, tested, aligned, and tubed, mounted on a separate chassis ready for use. Champion models are supplied with the Dumont Inputuner giving continuous tuning for all 13 channels plus FM Radio. Standard Models are supplied with a standard tuner which will handle 13 channels, completely wired ready for use with above unit. All Television Assemblies are complete with all components, schematics, and pictorial diagrams supplied.

SEE YOUR LOCAL NATIONAL PARTS DISTRIBUTOR

TELEVISION ASSEMBLY CO.

540 BUSHWICK AVE.
BROOKLYN 6, N. Y.

ten, we have had the pleasure of re-contacting several of the hams over the air who are using this idea, and they are quite sold on it. The quality observed so far is average for plate modulated phone as heard on the amateur bands, with some of it as good as broadcast quality. Those who have worked T12EA of Costa Rica have heard it applied to an 807.

We recently built several 813 jobs, and failing to obtain a suitable modulation transformer for the last one, we resorted to Heising modulation, using a common receiver type filter choke. Again, the quality and percentage of modulation were excellent. A 6F6 type tube seemed to be superior for the modulator, in this system, although the other tubes still worked. 1600 volts was used on the plate of the 813, a common receiver supply of 380 volts was used for the r.f. and audio sections as well as the 813 screen. 6L6's were substituted for the two 6V6's in the r.f. portion and the .0005 grid coupling condenser was changed to a .0001 in order to reduce the grid current to the 813. The developed grid voltage in the grid can be measured by connecting a voltmeter from the junction of RFC_1 and R_c in the grid circuit to ground. It should read around 130 volts for 1250 to 1500 volt plate supply, and may be varied by change in excitation.

As a test this last transmitter was loaded to 400 ma. on the plate with the voltage reading 1500. This gave 600 watts input and a cherry red 813 tube, but the modulation and quality were still excellent.

Tuning up for best quality is accomplished by watching the antenna meter or a neon bulb held near the final tank. Load up the final until "upward" modulation is noticed, or until an increase in antenna current is noted when a tone is fed into the speech amplifier. If the 813 plate runs too red to suit you, reduce the input by detuning the oscillator plate tank or by reducing the 813 grid coupling condenser. In all circuits shown, the quality is better if a well regulated screen voltage is used.

Under actual use, when properly adjusted, the plate current milliammeter will show an increased reading under modulation. If this increase is not observed, the reason may be either insufficient plate loading, or a poorly regulated screen voltage supply. The remedy is obvious. —30—

"Something is wrong!"

KIT 866A's & XFORMER, input 115 VAC/50-60cys, output 2.5VCT/10 Amps 10 KVinsulation and JOHNSON sockets & TUBES, SPECIAL $5.95
KIT GE872A's&XFRMR, 12.5KV, insltn & sockets, SPECIAL $12.95

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COMPLETE TELEVISION POWER SUPPLY Kit Hi Voltage 5000 VDC/5ma Lo Voltage 300VDC/175ma output, fil 6.4V/10.3A, fil 5.4V/8A, 5.1V/3A& 5V/3.5A inpt 105.115.125V/50 to 425 cys & sockets & Rect tube 5U4G&B24& filter condensers & choke & diagram oil filled USN Transf W.E. D303184 "TAB" SPECIAL $27.95
TRANSFORMER ONLY 22.95
SAME TELEVISION POWER SUPPLY KIT & added parts for providing HI VOLTAGE DOUBLER circuit—with 10000 Volts dc output "TAB" SPECIAL $34.95
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7.5V/12A/HV $4.95; 4x6.3V/4A&3x5V/4A 4.50
10VCT/10A/220Vin or 5VCT/10A/110Vin 4.95
5VCT/20A/220Vin or 2.5VCT/20A/110Vin 5.95
10VCT/10A,12VCT/.7A,3x6V/1A,2x6V/2A 7.95
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1 WATT XMTR FOUNDATION

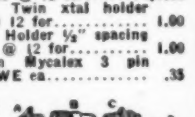
Amazing 1W XMTR basic assy consisting of metal frame w/10 cont fem receptacle,140 mmfvar cond, min polystyrene coil socket,dual Xtal socket & male contact socket w/spring locking clip. FULL INSTRUCTIONS, only 20c ea., 6 for $1.00

COMPLETE UNIT w/coils less Xtals $0.39

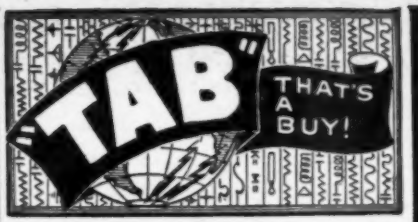
SOCKETS for XTAL HOLDERS

(A) 4xtal Holder ⅛"pins/3/4& ½"spacing 10c @ 12 for $1.00
(B) Hi freq Twin xtal holder FT243 10c @ 12 for 1.00
(C) HF xtal Holder ½" spacing ½" pins 10c @ 12 for 1.00
(D) Johnson Mycalex 3 pin BENDIX & WE ea. ..... .35

COAXIAL FITTINGS PLUGS & SOCKETS



(A) 83IR/SO239 Receptacle 35c @ 10 for $3.25
(B) 83ISPN PL259A PLUG 40c @ 10 for $3.75
(AB) PLUG & SOCKET 83IR&SPN 70c; 10/6.75
(C) AN3102-8S-1S PLUG 35c @ 10 for 3.00
83IH/M360 HOOD 11c @ 10 for 1.00
(D) M359 ANGLE plug adaptor 40c @ 10 for 3.75
10H702/46Q5335—SOCKET 25c @ 10 for 2.00
10H628/46RR5Y—PLUG BR 25c @ 10 for 2.00
(E) UG9U PLUG $1.08 @ 10 for 10.00
(E) 9I-MC4M MIKE Amphenol Plugs 35c; 10/3.00
(F) UG 22/U PANEL JACK $1.45 @ 10 for .. 12.50
UG 21/U PLUG $1.65 @ 10 for 15.00
PL172 for SCR522/PE94 Dynmtr 69c @ 10 for 6.00
JONES 201 HF Plug & Socket 49c @ 10 for. 4.00



GE GL434A similar to 7C29 TRIODE useable maxinpt 110mc's UP to 1200 Watts input, UP to 600W output. 3 Terminal Grid & C.T. filament, forced air Cooling 75-200CFM, Ef 10-11V, Dsgn for RADAR/BC-677 operated 215mc's/ 12KV/310ma inpt.
"TAB" SPECIAL $7.95
REL36ACORN similar 6J4 ..... 1.98
9LP7 Magnetic DEFL & FOCUS Suitable for TELEVISION 3.98

"TAB" STANDARD & JAN TUBES

OA4G	$1.04	6S7	$0.87	922	$1.49
OZ4	.85	6SA7GT	.54	923	.75
1B3GT	2.00	6SC7	.71	931A	3.95
1B21/471A	2.95	6SF5	.60	954	.45
1B24	2.95	6SG7	.71	955	.63
1B27	3.95	6SH7	.63	956	.63
1D5GP	1.25	6SJ7	.72	957	.45
1E7GT	1.39	6SJ7GT	.58	958A	.63
1G6GT	.85	6SK7	.58	991	.25
1L4	.70	6SL7	.85	1613/6F6X	.59
1LC6	1.05	6SN7GT	.69	1614/6L6X	1.50
1LH4	1.05	6SQ7	.54	1616	1.39
1LN5	.81	6SS7	.71	1619	.39
1P5GT	.63	6V6GT	.69	1622	1.69
1P24	2.95	6U7G	.58	1624	.98
1R4/1294	1.00	6X4	.53	1625	.45
2AP1A	2.85	6X5	.81	1626	.45
2A3	1.04	6Y6G	.87	1629	.58
2C21/1642	.81	6Z4/84	.69	1635	1.90
2C26	.59	6Z7GT	1.23	1641	.75
2C34/RK34	.55	7BP7/1813	3.95	2050	.88
2C40/446A	.81	7C29/434	7.95	2051	.88
2C43	2.98	7C4/1203	.45	7193	.38
2D21	1.49	9JP1	3.95	8005	4.70
2E22	1.45	9JP12	4.50	8012	4.70
2E25/HY65	2.95	9LP7	4.35	8013A	3.95
2J21/725	12.95	10Y	.60	8020	3.49
2J26	12.95	12A6	.49	9001	.49
2J30	18.50	12AH7GT	.87	9002	.59
2J31	16.95	12AR7	.95	9003	.49
2J32	16.95	12DP7	14.75	9004	.49
2J33	14.50	12GP7	14.75	9006	.45
2J34	18.95	12SA7GT	.58	C6J	4.95
2J42/700	29.95	12SC7	.65	CE206	3.95
2J49	29.95	12SH7	.71	CE215	5.95
2J55	38.00	12SK7	.58	CK1005	.35
2J61A	39.95	12SQ7	.58	F127A	18.00
2K25	9.95	12X3	.90	FG104	14.95
2K28	7.00	15E	1.39	FG105	11.95
2K29	6.95	24G/3C24	.68	FG166	49.00
2V3G	1.05	25L6GT	.68	REL36/6J4	1.98
2X2	.54	25Z5	.53	HY65/2E25	2.95
3A4	.70	35L6GT	.58	WE215A	1.80
3B7/1291	.95	35Z5GT	.45	RX215	7.95
3B24	1.27	37	.78	T200	12.00
3BP1	1.49	41	.58	VR90/OB3	.74
3BP1A	2.95	50L6GT	.58	VR92	.39
3C23	4.95	80	.52	VR105	.74
3D6/1299	.85	83V	1.05	VR150	.90
3E29/829B	3.85	117Z6	1.10	WL468	9.95
3FP7	3.98	205B/VT2	1.98	WL530	49.50
3JP12	2.95	211	.89	WL531	9.95
3S4	.69	250TH	19.49	WL619	20.00
4J47	39.95	250TL	19.49	WL632A	12.95
5AP1	2.75	304TH	5.95	UX6653	2.95
5BP1/5GP1	1.95	304TL	1.98	TUNGAR*	
5BP4	3.95	307A/RX95	4.25	20X672**	2.95
5CP1	3.85	388	.49	190698**	2.95
5D21	19.00	393	5.95	289881**	2.50
5FP7	2.95	450TH/ 6C21	24.90	MAZDA PL**	
5HP1	4.95	450TL	29.95	49**Box 10	.60
5R4G	1.25	527/1000S	11.95	64**	.07
5T4	1.25	631P1/8N4	3.95	86/T4**	.14
5U4G	.53	632A	8.95	100W/20V**	.25
5V4	.87	701A	3.95	313/28V**	.10
5W4	.87	702A	3.49	323/3V**	.10
5Y3	.38	703A	4.90	Aviation Lgts	
5Z3	.89	704A	1.75	C1249/12V	
5Z4	.88	705A	2.25	G4-25 for	1.00
6AB7	.98	707B/2K28	6.95	Sealed Beam	
6AC7	.81	710A/8011	2.75	4522/250W	1.49
6AG5	.93	717A	1.49	4560/600W	3.50
6AG7	1.05	722/287A	9.95	NEON BULBS	
6AJ5	.98	723AB	5.50	NE2-100Qty	4.50
6AK5	.90	726A	6.95	NE16/991	.25
6AL5	1.11	802	2.95	NE51 or NE20	.08
6B4G	1.28	803	7.95	Qty100-NE20	6.00
6B8G	1.05	804	9.75	SOCKETS for	
6C4	.27	805	4.50	2X2HV	.30
6C5	.54	807	1.24	705/715	.69
6C6	.71	808	2.25	803/304T	.90
6C8G	1.05	810	6.95	807	.27
6D4	1.85	811	2.20	829/832	.25
6D6	.59	813	6.95	866	.24
6E5	.71	814	2.98	872/211	.49
6F6/1613	.69	815	2.49	ACORN 5 for	1.00
6F8	1.04	816	1.15	Diheptal	.69
6G5/6U5	.85	826	.72	Maginal	.59
6G6G	.86	828	10.00	Loktal 4988L	.24
6H6	.54	829B/3E29	3.95	Octal 7888	.06
6H6GT	.54	832	3.75	Octal 4988	.15
6J4	5.95	836	1.12	Min 59500	.12
6J5	.53	837	2.25	Min & SH	.25
6J6	.90	845	4.75		
6J7	.70	860	2.49	PRICES SUBJECT TO CHANGE	
6K5GT	.86	864	.67		
6K6GT	.54	865	1.00		
6K7	.70	866A	1.00		
6K8	.86	868	1.85		
6L6	1.27	872A	2.45		
6L6G	1.04	884	.89		
6L7	.85	918/CE1C	1.49		
6N7	.85				

ELECTROLYTIC AND MICA CONDENSERS

Electrolytic Condensers

Mfd.	WVDC	Each
(A) Tubular, metal case, paper cov., lug term.		
40	450	$0.55
300	25	.30
500	200	1.49
6000	15	1.98
2-Section		
30	350	.65
30	300	
3-Section		
30-15-10	250	.45
40	150	.50
40-20	25	
40-20-20	150	.40
80-12-10	150	.50
100	50	.50
40-20	150	
(B) Tubular, metal, screw mtg, wire leads.		
12	450	.47
40	200	.50
500	10	.40
(E) Tubular, pigtail mtg & term.		
8	150	.18
8	450	.27
10	25	.15
10	50	.23
24	150	.35
2-Section		
8-8	450	.49
10	350	.39
20	25	
(F) Tubular, metal, lug term.		
10	250	.30
20	25	.15
20	200	.35
25	250	.40
25	300	.45
25	400	.50
25	475	.54
40	450	.65
50	25	.20
50	400	.85
200	200	1.39
250	25	.39
250	150	1.29
2, 3 and 4 Section		
10	350	.39
20	25	
15-15	350	.49
8-8	350	.60
20	150	
4x10	400	.70
(G) Tubular, prong mtd, lug term.		
10	450	.35
40	25	.20
250	10	.30
500	60	.98
2-Section		
10-10	200	.40
10-10	450	.50
2x1000	15	1.20
10	300	.45
40	25	
25-10	450	.55
40	250	.45
20	25	
50	450	.85
10	250	

Mfd.	WVDC	Each
(G) 3-Section		(Cont'd)
10-10	350	$0.50
10	25	
10	350	.50
10	300	
20	25	.50
10	200	
10	150	.50
20	25	
10-10-5	350	.50
20-20	400	.50
20	25	
20	350	.50
10	300	
20	25	.50
20	400	
10	400	.50
20	25	
40	300	.50
20	25	
20	50	.50
40-30	150	.45
25	25	
40-40	150	.50
10	25	
3X40	150	.65
4-Section		
10-10	250	.50
5	300	
20	25	.45
8-8	350	
2-4	250	.50
10	350	
10	300	.50
10	250	
20	50	.50
12-12	450	
30-30	25	.50
15-15	200	
40	25	.45
20	25	
15-15	400	.55
40-40	25	
20-10	350	.50
5	300	
10	25	
20	400	.65
20-10	250	
40	25	.35
4X40	25	
40	475	.75
15	350	
15	150	
15	25	
(I) Tubular, plug-in term.		
100	25	.45
20	20	.35
30	30	.40
20-20	350	.50
(J) Tubular, screw mtd, lug term.		
8	450	.35
16	450	.45
50	350	.50
125	250	.65
1000	30	1.25
2000	5	.75
2-Section		
8-8	400	.45
15-15	450	.50
18-18	250	.40
20	150	
1000	5	.95
25-25	300	.45
25-40	450	.65
60-20	400	.80
20-40	350	.98

MICA CONDENSERS

Mfd.	WVDC	Each
(C) Lug Term.		
.0002	500	$0.30
.0003	600	.30
.00089	1200	.45
.001	500	.30
.001	750	.40
.002	1200	.50
.003	600	.30
.0039	2500	1.26
.005	600	.30
.005	1200	.70
.006	600	.30
.008	600	.30
.0082	2500	1.45
.01	600	.45
.01	1200	1.12
.01	2500	1.64
.026	500	.92
.03	600	1.00
.043	600	1.65
(D) Screw term.		
.0004	2500	.36
.00047	2500	.39
.00055	600	.30

Mfd.	WVDC	Each
.0012	600	$0.30
.002	2500	.90
.003	600	.30
.0035	2500	1.15
.0043	2500	1.26
.005	600	.30
.005	2500	1.32
.005	3000	1.45
.0051	1200	.70
.006	2500	1.38
.0062	1200	.70
.01	500	.45
.01	1200	1.12
.01	2500	1.64
.013	1200	1.28
.015	2500	1.78
.02	600	.74
.03	600	1.00
.03	1200	1.90
.033	600	1.10
.033	1200	1.90
.05	600	1.90
(H) 25mmf. Sulfur Mica, 10KV Working RF		$0.98

It's Only Natural

FOR RADIO MEN TO ASSEMBLE THEIR OWN

Heathkit ELECTRONIC SWITCH KIT
DOUBLES THE UTILITY OF ANY SCOPE

...s two separately controllable traces with individual inputs on any scope.

See both the input and output traces, locate distortion, phase shift, etc., immediately.

Individual gain controls and positioning control. Coarse and fine sweeping rate controls. Complete Heathkit matches others, with 5 tubes, All metal parts are punched, formed and cadmium plated. Complete with tubes, all parts, detailed blueprints and instructions. Shipping Wt. 13 lbs.

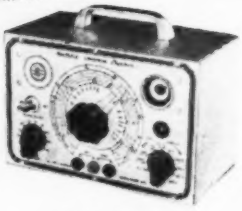
Nothing ELSE TO BUY

$34.50

- ★ Save ⅔ the cost.
- ★ Gain valuable knowledge.
- ★ Achieve better workmanship.
- ★ Learn many new applications.
- ★ Ideal training for use.

Heathkits are regular factory quality test equipment unassembled but with all forming, punching, calibrating and printing already completed.

HEATHKIT CONDENSER CHECKER KIT



A condenser checker anyone can afford to own. Measures capacity and leakage from .00001 to 1000 MFD on calibrated scales with test voltage up to 500 volts. No need for tables or multipliers. Reads resistance 500 ohms to 2 megohms. 110V 60 cycle transformer operated complete with rectifier and magic eye indicator tubes.

Easy quick assembly with clear detailed blueprints and instructions. Small convenient size 9" x 6" x 4¾". Weight 4 pounds. This is one of the handiest instruments in any service shop.

$19.50

Nothing ELSE TO BUY

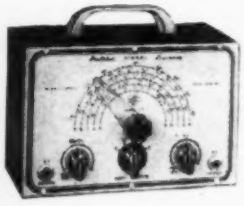
THE NEW HEATHKIT VACUUM TUBE VOLTMETER KIT

The most essential tool a radio man can have, now within the reach of his pocketbook. The Heathkit VTVM is equal in quality to instruments selling for $75.00 or more. Features 500 microamp meter, transformer power supply, 1% glass enclosed divider resistors, ceramic selector switches, 11 megohms input resistance, linear AC and DC scale, electronic AC reading RMS. Circuit uses 6SN7 in balanced bridge circuit, a 6H6 as AC rectifier and 6 x 5 as transformer power supply rectifier. Included is means of calibrating without standards. Average assembly time less than four pleasant hours and you have the most useful test instrument you will ever own. Ranges 0-3, 30, 100, 300, 1000 volts AC and DC. Ohmmeter has ranges of scale times 1, 100, 1000, 10M and 1 megohm, giving range .1 ohm to 1000 megohms. Complete with detailed instructions. Add postage for 8 lbs.

$24.50

Nothing ELSE TO BUY

HEATHKIT SIGNAL GENERATOR KIT



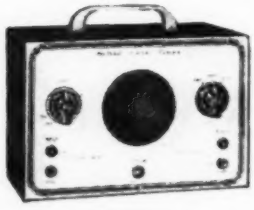
$19.50

NOTHING ELSE TO BUY

Every shop needs a good signal generator. The Heathkit fulfills every servicing need, fundamentals from 150 Kc. to 30 megacycles with strong harmonics over 100 megacycles covering the new television and FM bands. 110V 60 cycle transformer operated power supply.

400 cycle audio available for 30% modulation or audio testing. Uses 6SN7 as RF oscillator and audio amplifier. Complete kit has every part necessary and detailed blueprints and instructions enable the builder to assemble it in a few hours. Large easy to read calibration. Convenient size 9" x 6" x 4¾". Weight 4½ pounds.

HEATHKIT SIGNAL TRACER KIT



$19.50

Nothing ELSE TO BUY

Reduces service time and greatly increases profits of any service shop. Uses crystal diode to follow signal from antenna to speaker. Locates faults immediately. Internal amplifier available for speaker testing and internal speaker available for amplifier testing. Connection for VTVM on panel allows visual tracing and gain measurements. Also tests phonograph pickups, microphones, PA systems, etc. Frequency range to 200 Mc. Complete ready to assemble. 110V 60 cycle transformer operated. Supplied with 3 tubes, diode probe, 2 color panel, all other parts. Easy to assemble, detailed blueprints and instructions.

Small portable 9" x 6" x 4¾". Wt. 6 pounds. Ideal for taking on service calls. Complete your service shop with this instrument.

HEATHKIT SINE AND SQUARE WAVE AUDIO GENERATOR KIT

$34.50

Shipping Wt., 13 lbs.

The ideal companion instrument to the Heathkit Oscilloscope. An Audio Generator with less than 1% distortion, high calibration accuracy, covering 20 to 20,000 cycles. Circuit is highly stable resistance capacity tuned circuit. Five tubes are used, a 6SJ7 and 6K6 in the oscillator circuit, a 6SL7 square wave clipper, a 6SN7 as a cathode follower output and 5Y3 as transformer power supply rectifier.

The square wave is of excellent shape between 100 and 5,000 cycles giving adequate range for all studio, FM and television amplifier testing.

Either sine or square wave available instantly at a toggle switch. Approximately 25V of sine AC available at 50,000 ohm output impedance. Output ± 1 db. from 20 to 20,000 cycles. Nothing else to buy. All metal parts are punched, formed and cadmium plated. Complete with tubes, all parts, detailed blueprints and instructio...

The HEATH COMPANY

DEPT. N . . . BENTON HARBOR, MICHIGAN

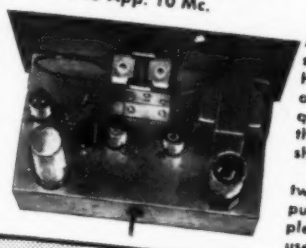
TEST EQUIPMENT

New! HEATHKIT FM and TELEVISION SWEEP GENERATOR KIT

THE BASIC FM AND TELEVISION SERVICE INSTRUMENT . . . .

Features –

- ★ Covers 2 Mc. to 226 Mc.
- ★ 110 V 60 cy transformer.
- ★ Supplies either RF or FM.
- ★ Variable sweep width 0 to App. 10 Mc.
- ★ 5 Tube Circuit
- ★ Large calibrated dial.
- ★ Variable phasing control.
- ★ Sweep output for scope.
- ★ No band switching necessary.
- ★ Uses new miniature HF tubes.



At the lowest cost possible, anyone can now service FM and television receivers. The Heathkit sweep generator kit operates with oscilloscope and covers all necessary frequencies. A few pleasant hours assembling this kit puts any organization in position to share the profits of the FM and TV boom.

Every part supplied — grey crackle cabinet, two color calibrated panel, all metal parts punched, formed and plated. 5 tubes, complete detailed instructions for assembly and use. Shipping weight 6 lbs.

$24.50

Enjoy the profits now of this new field

HEATHKIT HIGH FIDELITY AMPLIFIER KIT

$14.95

Build this high fidelity amplifier and save two-thirds of the cost. Push pull output using 1619 tubes (military type 6L6's), two amplifier stages using a dual triode (6SN7), and a phase inverter give this amplifier a linear reproduction equal to amplifiers selling for ten times this price. Every part supplied; punched and formed chassis, transformers (including quality output to 3-8 ohm voice coil), tubes, controls, and complete instructions. Add postage for 20 lbs.

12" PM speakers for above $6.95

HEATHKIT 3-TUBE ALL-WAVE RADIO

110-volt AC operation

$8.75

An ideal way to learn radio. This kit is complete ready to assemble, with tubes and all other parts. Operates from AC. Simple, clear detailed instructions make this a good radio training course. Covers regular broadcasts and short wave bands. Plug-in coils. Regenerative circuit. Operates loud speaker.

Add postage for 3 lbs.

HS 30 Headphones per set $1.00

2½" permanent magnet loudspeaker $1.95

INTERPHONE 2-WAY CALL SYSTEM KIT

Ideal call and communication system for homes, offices, factories, stores, etc. Makes excellent electronic baby watcher, easy to assemble with every part supplied including simple instructions. Distance up to 1/5 mile. Operates from 110 V.A.C. 3 tubes, one master and one remote speaker. Shipping Weight 5 pounds.

$14.50

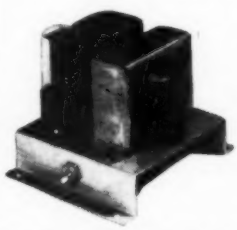
NEW 1948 HEATHKIT 5" OSCILLOSCOPE KIT

A necessity for the newer servicing technique in FM and television at a price you can afford. The Heathkit is complete, beautiful two color panel, all metal parts punched, formed and plated and every part supplied. A pleasant evening's work and you have the most interesting piece of laboratory equipment available.

Check the features — large 5" 5BP1 tube, compensated vertical and horizontal amplifiers using 6SJ7's, 15 cycle to 30 M cycle sweep generator using 884 gas triode, 110V 60 cycle power transformer gives 1100 volts negative and 350 volts positive.

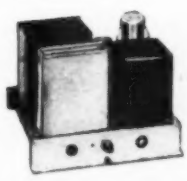
Convenient size 8½" x 13" high, 17" deep, weight only 26 pounds.

All controls on front panel with test voltage and ext. syn post. Complete with all tubes and detailed instructions. Shipping weight 35 pounds. Order today while surplus tubes make the price possible.



110 V. A.C. MILITARY RECEIVER POWER SUPPLY KIT

Ideal way to convert military sets. Supplies 24 Volts for filament — no wiring changes inside radio. Also supplies 250 V. D.C. plate voltage at 50-60 MA. Connections direct to dynamotor input. Complete with all parts and detailed instructions. Ship. Wt., 6 lbs. **$ 5.95**



$14.50

110 V. A.C. TRANSMITTER POWER SUPPLY KIT

For BC-645, 223, 522, 274N's, etc. Ideal for powering military transmitters. Supplies 500 to 600 Volts at 150 to 200 MA plate, 6.3 C.T. at 4 Amps, 6.3 at 4 Amps and 12V at 4 Amps. Can be combined to supply 3-6-9-12 or 24 Volts at 4 Amperes. Kit supplied complete with husky 110V 60 cycle power transformer, 5U4 rectifier, oil filled condensers, cased choke, punched chassis, and all other parts, including detailed instructions. Complete — nothing else to buy.

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APN/1 RADIO ALTIMETERS

NO. 200. The last chance to get a complete new 14 tube radio altimeter. Contains 420 Mc. transmitter and receiver, power supply, range switches, twe antennas, meter indicator, all plugs and instruction manual. This unit makes excellent amateur station as it is right in the band. Shipped in original export crate. Weight 87 lbs.

$34.50

BC 645 GENERAL ELECTRIC TRANSCEIVER

NO. 201. Complete 15 tube transmitter-receiver. Ideal for new citizens band 460 Mc. for communication between office and car, home, boat, etc. Conversion article in August ELECTRONICS Magazine. Brand new in original G.E. cartons with tubes. Add postage for 25 lbs.

$19.50 . . . 2 for $35.00

ACCESSORIES FOR BC 645

PE101C Dynamotor for car use ..... $ 3.95

110V 60 Cycle Power Supply for home or office use ... $14.50

RCA NAVY COMMUNICATION RECEIVER

NO. 202. The last of these beautiful RCA sets. Covers 195 Kc. to 9.1 Mc. continuously. Supplied complete with tubes, control box, tuning unit, 24 Volt dynamotor, band change motor, plugs and circuit diagram. Superheterodyne circuit covers aircraft, broadcast, short wave, marine, foreign broadcasts. Has sharp or broad I.F.'s B.F.O., etc. Shpg. Wt. 30 lbs.

$29.50

G.E. BC 375 TUNING UNIT

NO. 203. Model TU10B covers 10 Mc. to 12.5 Mc. New complete with aluminum cabinet. The best buy of surplus. Over $30.00 worth of new variable condensers, coil, dials, switches, etc. Add postage for 20 lbs.

$2.49

G.E. 50 AMP CIRCUIT BREAKER

$2.95 EACH—3 FOR $7.50

NO. 204. New General Electric 50 Amp 220 Volt AC circuit breakers. 100 Amp when used on 110V. Add postage for 4 lbs.

T32 TABLE MICROPHONE

NO. 210. One of the Army's best. Built by Kellogg, ideal for factory call system, public address, amateur use. Brand new in original cartons. Add postage for 5 lbs.

$2.95

MINIATURE ELECTRIC MOTOR

NO. 211. Tiny Delco motor only 1" x 1¼"x2" 10,000 RPM. Operates from 6 to 24 V. Excellent for models. Add postage for 1 lb.

$2.95

BC 347 AIRCRAFT INTERPHONE AMPLIFIER

NO. 205. Interphone amplifier contains 6F8 tube, Ouncer transformers, diagrams, etc. in aluminum cabinet. Add postage for 4 lbs.

$2.95

P. E. 103 6 VOLT DYNAMOTOR

NO. 212. Dynamotor only from PE 103 power supply. Input 6 or 12 Volts, output 500 Volts at 160 MA. Brand new original cartons. Shipping Weight 29 lbs.

$5.95

PE 125 TRANSMITTER POWER SUPPLY

$12.95

NO. 223. Operates from 12 to 24 Volts and supplies 500 Volts at 160 MA. Extremely rugged construction used in Army tanks. Complete with fuses — relays — filters, etc. Ideal for boats. Shipping Weight 73 lbs.

FM PUSH BUTTON TUNER

NO. 224. Brand new ten push button tuning assembly from Army FM receiver. Contains 4 gang 100 MMF silver plated tuning condenser. Add postage for 10 lbs.

$2.50 EACH

274N COMMAND SET ACCESSORIES

NO. 238. 5" PM Speaker with output transformer matching headphone output $2.80

NO. 239. Dual receiver rack FT277A with connecting plugs $1.00

NO. 240. Single transmitter rack FT234A $1.00

NO. 241. Spline shaft for tuning command receivers. Allows use of regular tuning knob on BC 453-4-5 receivers ..... $ .39

BC 451 CONTROL BOX

NO. 236. Control box for 274N transmitters. Contains proper cw-voice switch, 4 channel switch, power switch, mike jack and telegraph key.

Add postage for 2 lbs. $1.95

G. E. 1,000 VOLT 350 MA DYNAMOTOR

$5.95

NO. 213. An ideal dynamotor for mobile operation in taxicabs, police cars, sound systems and amateur stations. Supplies above voltage from 12 Volts or 500V. at 350 MA from 6 Volts. Complete with starting relay, and fuses. New. Our Dynamotor A. Shipping Weight 72 lbs.

DM-36 DYNAMOTOR

NO. 215. Western Electric 24 Volt input, 220V. at 60 MA out. With filter assembly. Shipping Weight 6 lbs. **$2.95**

POWER TRANSFORMER *Specials*

NO. 226. Primary 117V. 60 cycle. Secondaries supply 746 V.CT at 220 MA, 6.3V. at 4.5 A., and 5V. at 4A. Will handle 13 tube radio receivers. Supply is limited, order early. Shipping Weight 11 lbs. each.

$3.95 . . 3 for $9.95

OUTPUT TRANSFORMER

NO. 227. Push pull 6V6's to 6 - 8 ohm voice coil excellent characteristics, ... 3 for $1.95

TRANSMITTER TRANSFORMER

NO. 228. The transformer for Transmitter Power Supply, 600 Volt at 200 MA and 4 Amp. filaments of 3 to 24 Volts. Also 5 Volts at 4 amperes for rectifier. Shipping Weight 12 lbs. **$9.50**

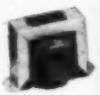
METER SPECIAL

NO. 237. Brand new DeJur Model 312 0-800 M.A. D.C. Square 3" 0-10 M.A. basic meter with built in shunt. Probably the best buy ever offered in a surplus meter. Shipping Weight 1 lb. **$2.95**

G.E. BC 306 ANTENNA TUNING UNIT

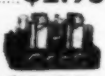
NO. 231. Matches any aerial to 150 Watt transmitter, used on BC 375. Brand new. Add postage for 20 lbs. **$2.95**

MILITARY POWER TRANSFORMERS



NO. 229. Convert your military receivers without rewiring the filament. "A" type supplies 500 VCT at 50 MA, 5V. at 2A. and 24V. at ½ A. "B" type supplies 500 VCT at 50 MA, 5V. at 2A. and 12V. at 1 Amp. State whether A or B type desired. Shipping Weight 4 lbs. **$2.95**

W.E. BC456 MODULATOR



NO. 217. Modulator from 274N command transmitters contains 3 husky relays, 3 tubes, VR150, 12J5 and 1625. Brand new. Add postage for 11 lbs.

$3.95

A-62 ARMY PHANTOM ANTENNA

NO. 206. Contains tuning condenser, coil, resistors, tuning dial, tuning indicator, binding posts, steel case, useful for building amateur transmitter. Add postage for 8 lbs. **$1.95**

BE 77 TELETYPE TEST SET

$7.95

NO. 218. Contains zero center volt-milliammeter, switches, relays, voltage divider resistors, neon indicator, etc. Excellent foundation for radio tester. Shipping Weight 10 lbs.

HOME WORKSHOP GRINDER KIT

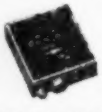
NO. 230. Easily assembled 110V AC or DC ball bearing fully enclosed motor from Army surplus dynamotor. Purchaser to make simple changes and shaft extensions, detailed instructions and all parts supplied. Motor approximately 5,000 R.P.M. Ideal for tool-post grinder, flexible shaft tool, model drill press, saw. Shipping Weight 6 lbs.

$3.95

BENDIX MN 20E DIRECTION FINDER LOOP

NO. 219. Ring type loop excellent for use on boat or aircraft. Extremely rugged construction. Low impedance manual type. Add postage for 8 lbs. **$9.95** EACH

BENDIX MR9C COMPASS CONTROL UNIT

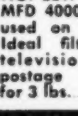


NO. 207. Tuning and control unit for Bendix MN 26 radio compasses contains tuning dial, band switch, crystal switch, AVC switch, volume control, fuses, phone jacks, etc. Shipping Weight 5 lbs. **$9.50**

LP 18C DIRECTION FINDER LOOP

NO. 220. Motor driven streamline pod type loop used on automatic direction finders. Has Selsyn transmitter and motor, fits most military direction finders. Add postage for 20 lbs. ..... **$14.50** EACH

HEARING AID HEADPHONES



NO. 216. The Army's best — eliminate flat ears and outside noise. Complete with transformer for conversion from low to high impedance. With cord and plug complete.

Add postage for 1 lb. **$1.00**

BC731 CONTROL BOX with Weston Model 476 AC Voltmeter

NO. 208. Excellent buy in motor control box. Size 8"x10"x5½". Contains Weston 0-150V. AC 3½" voltmeter, motor starting switch, 28 fuses all 30 Amp 110V. and 8 fuse holders. Fuses and holders alone worth the price. Shipping Weight 18 lbs. **$7.95**

TELEVISION CONDENSERS

NO. 221. Tobe triple .2 MFD 4000 V.D.C. Filter used on Army radar. Ideal filter for H.V. television set. Add postage for 3 lbs. $3.95

NO. 222. G.E. Pyranol capacitor .25 MFD 6000 V.D.C. Porcelain insulated, an outstanding buy for high voltage filters. Add postage for 3 lbs. $3.95

KIT SPECIALS

POTENTIOMETERS

NO. 232. Kit of 10 excellent shaft type potentiometers good variety **$1.95**

SOCKETS

NO. 233. Kit of 20 high quality sockets several different types **$1.00**

HOW TO ORDER

GIVE PART NUMBER AND DESCRIPTION . . . ADD POSTAGE FOR WEIGHT SHOWN. NO ORDERS UNDER $2.00 . . . WE WILL SHIP C.O.D.

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STANCOR FILAMENT TRANSFORMER

NO. 242. Heavy duty Stancor No. ST355 supplies 5V at 6 Amps, 5V at 3 Amps and 5V at 3 Amps from 220V 60 Cy. primary or ½ above from 110V. Cased type. Ship. Wgt. 7 lbs. Each **$1.50**

G.E. THYRATRON TRANSFORMER

NO. 243. New G.E. Transformer supplies 2.5V at .100 KVA, has 3KV insulation 100V 60 cy. primary. Shipping Wgt. 13 lbs. Each **$9.50**

RCA SATURABLE REACTOR TRANSFORMER

NO. 246. New RCA No. CRV30531 AC current 750 MA DC current 2 Amperes. Rated 1.75 henries. Shipping wgt. 4 lbs. Each **$1.00**

12.6V POWER TRANSFORMER

NO. 247. New cased 110 V 60 cy. Power Transformer. Supplies 440V Ct. at 60 MA, 6.3V at 2A. and 12.6V at 1 Amp. Excellent for military sets. Shipping Wght. 6 lbs. Each. **$1.95**

RCA INPUT TRANSFORMER

NO. 248. Heavy duty RCA No CRV-30529. Input has primaries 600 to 200 and 25 ohms secondary 250,000 ohms C.T. Shipping Wgt. 2 lbs. Each **$1.00**

REPLACEMENT POWER TRANSFORMER

NO. 251. Excellent value transformers made by one of largest transformer companies. 110V 60 cy. Primary supplies 746 V Ct. at 150 MA. 5V at 4A and 6.3V at 4.5 Amps. Shipping Wgt. 7 lbs. Each **$2.95**

FEDERAL POWER TRANSFORMER

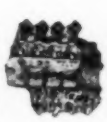
NO. 252. New cased 110V 60 cy. Power Transformer. Supplies 480V CT at 50 MA and 6.3 V at 2.1 Amps. A beautiful transformer. Shipping Wgt. 4 lbs. Each **$1.50**

HEAVY DUTY 6-12-24 VOLT VIBRATOR

NO. 253. A husky vibrator used on army transmitter. Rated 30 amperes at 6 Volts 220 cycle with contacts for 12 and 24 Volts. Synchronous type, has many industrial applications. Ship. Wgt. 3 lbs.

4 CHANNEL PUSH BUTTON TUNER

NO. 254. Permeability tuner from BC 728 containing RF, first detector, and oscillator coils. Covers 2 to 5 MC. Complete circuit diagram furnished. Shipping Wgt. 2 lbs. Each **$2.50**



CONDENSER SPECIAL

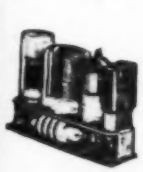
NO. 255. An ideal oil filled power supply filter used in army 16 tube unit, has 2.5, 2.5 and 5 MFD all at 600V D.C. rating. Shipping Wgt. 3 lbs. Each **$1.50**

AEROVOX TELEVISION CONDENSER

NO. 256. Aerovox Hyvol .05 MFD at 7500V. rating. Excellent television coupling condenser with mounting bracket. Shipping Wgt. 3 lbs. Each **$3.50**

BC 746 TUNING UNIT

NO. 257. Plug in transmitter tuning unit from army Walkie Talkie. Contains antenna and tank coils, tuning condenser, transmitting and receiving crystals. Ideal transmitter foundation. Shipping Wgt. 1 lb. Each **$1.00**
(Same as above except transmitter crystal in 80 meter amateur band ..... $2.50 each)

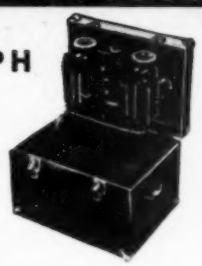


T30 THROAT MICROPHONE

NO. 258. Makes excellent contact microphone for musical instrument or vibration pick-up. Shipping Wgt. 1 lb. ..... $1.00 each
Extension cord with switch for above ..... $ .50 each

BRAND NEW ARMY AIR FORCE ASTROGRAPH

NO. 259. The case of this unit makes the finest tool and service kit ever designed. Plywood construction, 14 x 11 x 10" high, with 8 covered compartments in the bottom for repair parts, leather handle, steel reinforced covers, hinged lid. Also excellent as case for radio phonograph, movie projector, camera, shell case, fishing kit, picnic kit, etc. The astrograph itself, (which cost the government $125.00) makes an excellent contact printer, and can be used for a foundation for enlarger, strip map holder, etc. The case alone worth twice the give-away price of **$3.95**



AN27/ARN5 ANTENNA

NO. 260. Standard blind landing antenna system. Brand new in original crate. Ship. Wgt. 14 lbs. **$9.50**

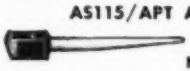
AS114/APT ANTENNA SYSTEM

NO. 261. New blade type antenna complete with case assembly, in original carton. Shipping Wgt. 9 lbs. **$7.50**

AS115/APT ANTENNA SYSTEM

$7.50

NO. 262. New blade type antenna complete with case assembly, in original carton. Ship. Wgt. 11 lbs.



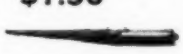
AT38A/APT RADAR ANTENNA

NO. 263. New radar dome type antenna with mounting base and connections, in original carton. Ship. Wgt. 11 lbs. **$14.50**

AN104A BLADE ANTENNA

$1.50

NO. 264. Standard blade antenna used on many military fighting planes with coaxial connection at base. Shipping Wgt. 3 lbs.



BENDIX MT51C TRANSMITTER CONTROL BOX

NO. 235. Contains channel switch, emission switch, send receive switch, power switch and indicators for Bendix aircraft transmitters. Ship. Wgt. 3 lbs. **$5.50**

BC 670B REMOTE CONTROL BOX

NO. 265. Motor starting control box has starting and stopping switch, indicator, cable and plug. Wooden case. Ship. Wgt. 6 lbs. Each **$1.95**

BK 22 RELAY ASSEMBLY

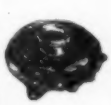
NO. 266. Used on SCR 269 Radio Compasses. Contains stepping and control relays — junction box of aluminum. Brand new. Ship. Wgt. 7 lbs. Each **$3.95**

HEINEMANN CIRCUIT BREAKER

NO. 267. Heavy duty type 7 Amp. 24 Volt D.C. Many uses around shop. Shipping Wgt. 2 lbs. Each **$1.00**

CUTLER HAMMER MOTOR FIELD CONTROL

NO. 285. Rated 10 ohms. 3.2 Amps. Maximum. 6½" diameter with knob and mounting feet, can be used to regulate generator output voltage. Shipping. Wgt. 5 lbs. Each **$2.50**



PENN THERMO RELAY

NO. 268. Thermo Relay with a range of 45° to 100° complete with 5 Ft. flexible cable to immersion bulb. Shipping Wgt. 6 lbs. **$3.50**

B & W 11 to 14 MC TANK COIL

NO. 281. Plug in type used on BC 610 Transmitter. New, original cartons. Shipping Wgt. 2 lbs. Each **$1.50**

DM 64A 12 VOLT DYNAMOTOR

NO. 269. Input 12V at 5 Amps. Output 275 Volt 150 MA. New. Shipping Wgt. 7 lbs. Each **$5.50**

DM 32A COMMAND SET DYNAMOTOR

NO. 270. Part of 274N Command Receivers. Input 28 Volts, output 250V at 60 MA. Shipping Wgt. 4 lbs. Each **$5.50**

DM 21 12 VOLT DYNAMOTOR

NO. 271. Used in Army BC 312 Communication Receiver. Input 12 Volts at 3.3 Amps. Output 235 Volts at 90 MA. New, original cartons. Shipping Wgt. 8 lbs. Each **$5.50**

PE94C SCR 522 POWER SUPPLY

NO. 272. Complete dynamotor power supply for the SCR 522, operates from 28 Volts. Complete with controls, filters, etc. Original carton. Shipping Wgt. 34 lbs. Each **$8.75**

PE101C BC645 POWER SUPPLY

NO. 273. Complete power supply for BC 645. Operates from 12 or 24 Volts. Supplies both AC and DC required. Shipping Wgt. 13 lbs. Each **$3.95**

DM 35 12 VOLT DYNAMOTOR

NO. 274. New input 12 Volt at 18.7 Amperes. Supplies 675V at 275 MA or ½ above voltage from 6 volts. Excellent for auto use. Shipping Wgt. 11 lbs. Each **$7.50**

PE 86 DYNAMOTOR

NO. 214. A popular 28 Volt receiver dynamotor used on present military equipment. Supplies 250V at 60 MA. Shipping Wgt. 4 lbs. Each **$5.50**

GN 58 HAND GENERATOR

NO. 275. Makes excellent home lighting plant, operated by wind propeller, waterfall, gas engine, or hand crank. Reduction gear allows full output at slow speed; supplies 6 volts at 2.45 amp., 425 volts at .115 amp. New. Add postage for 28 lbs. Each **$7.95**

Handles for GN 58 ..... $ .50 each
Connecting cord for GN 58 with plugs CD1086 ..... $1.50 each

COLLINS AUTOTUNE CONTROL HEAD

NO. 278. Brand new controls used on the ART/13, 100 Watt, Transmitter. Types 7, 8, 10, and 11 available. Get a spare while available as new cost is over $22.00 each. Shipping Wgt. 3 lbs. Price any type (mention when ordering). Each **$4.50**

MC 432 VHF ANTENNA LOADING UNIT

NO. 279. Contains 2 pole, 5 position rotary switch with silver ceramic variable condensers, and coils for matching VHF Transmitter to AN109 antenna with 50 ohm line. Many useful parts. Shipping Wgt. 2 lbs. Each **$1.50**

148 OUTDOOR TELEGRAPH KEY

NO. 280. Rugged enclosed type for outdoor use, built for army to withstand hard useage. Complete with cord and PL55 plug. Shipping Wgt. 2 lbs. Each **$2.00**

ONE KILOWATT ADJUSTABLE ANTENNA LOADING COIL

NO. 282. Huge porcelain coil 4" diameter 8¼" long, has 5 sliders for adjustments. Shipping Wgt. 5 lbs. **$3.50**

300 MA SELENIUM RECTIFIERS

NO. 209. Rated 300 MA at 36 Volts, complete with mounting brackets. Shipping Wgt. 1 lb. ..... **3 FOR $1.00**

DUAL SELENIUM RECTIFIER

NO. 283. Two units mounted on single bracket, each section rated 15V. at ½ Amp. Shipping Wgt. 1 lb. **2 FOR $1.00**

HOW TO ORDER • • • GIVE PART NUMBER AND DESCRIPTION . . . ADD POSTAGE FOR WEIGHT SHOWN. NO ORDERS UNDER $2.00 . . . WE WILL SHIP C.O.D.

The HEATH COMPANY

. . . BENTON HARBOR 15, MICHIGAN

A GRID BIAS SUPPLY FOR CLASS "B" MODULATORS

By H. C. SHERROD, W5ZG

Using copper oxide rectifiers, this unit will supply 50 volts at 100 milliamperes.

VACUUM tubes which require grid bias when operated as audio amplifiers or modulators under class B conditions, engender the problem of bias voltage regulation because of the magnitude of the fluctuating grid current.

Satisfactory operation of such units can, therefore, be achieved only through the use of a source of grid bias voltage which has sufficiently low internal resistance to make negligible the *IR* drop across the source of bias voltage occasioned by the grid current as compared with the magnitude of grid bias voltage employed.

The most common expedient employed to meet the foregoing requirement is the use of batteries to obtain bias voltage.

The advantages of the use of batteries for grid bias are:

1. Relatively low cost.
2. Compactness.
3. Sufficiently low internal resistance.
4. Relatively long life.

Disadvantages of batteries as a source of grid bias are:

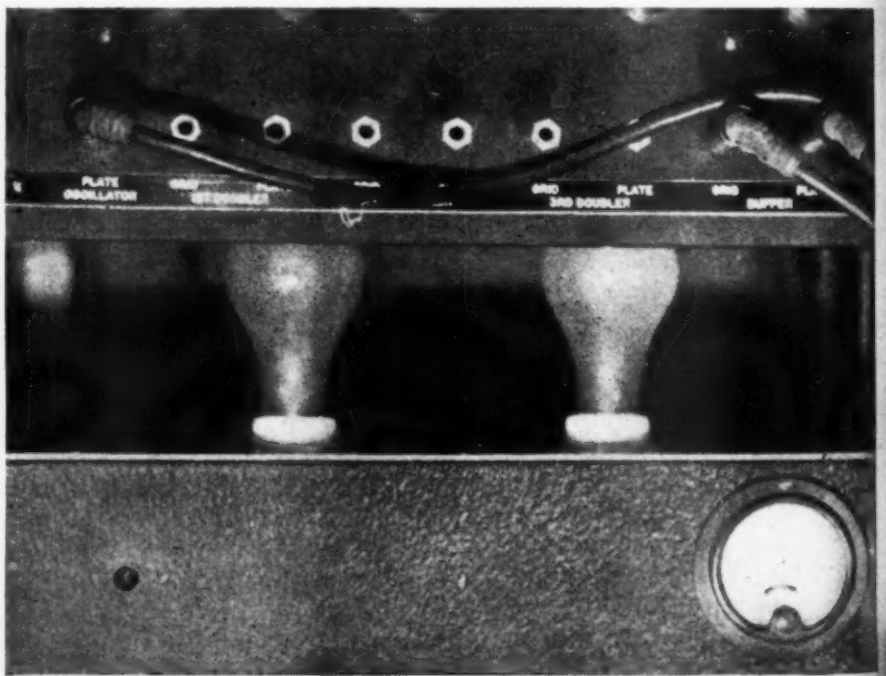
1. Eventual rupture of the battery due to charging effect of grid current.
2. Sweating and leaking of batteries at the end of their life, together with the corrosive effect of substances discharged.
3. Restriction on use of equipment occasioned by failure of the bias battery.

In the writer's case, it was desired to properly bias a pair of *Eimac* type 35T tubes operating in push-pull as class B modulators at 1500 volts plate potential. To comply with manufacturers' requirements, a bias voltage of —50 was necessary.

Design considerations were based on an assumed maximum grid current of 100 milliamperes for the two tubes.

If then, the bleeder resistance connected across the source of bias voltage carried a current of approximately 2.5 amperes, the resistance of this bleeder would be 50.0 volts divided by 2.5 amperes or 20 ohms. With zero signal on the grids, the current flowing through the bleeder resistance would be 2.5 amperes and the bias 50 volts. With maximum signal on the grids, the current flowing through the bleeder resistance would be 2.5 amperes plus 100 milliamperes (assumed

Fig. 1. Bias supply unit as installed, using 75 watt, 117 volt lamps.



PIEZOELECTRIC CERAMICS

The high-level output, immunity to magnetic fields, lightness, and general operating convenience of the crystal microphone and crystal pickup frequently have been outweighed for some uses by the lack of stability of the piezoelectric element. The rochelle-salt crystal is quickly damaged by excess humidity or high summer temperatures. This situation recently was changed when several manufacturers announced crystal microphones and pickups using ceramic piezoelectric elements which are immune to ordinary heat and humidity. Voltage output is down somewhat from rochelle salt, but this loss is more than compensated by the improvement in stability.

RADIO HANDBOOK

11th EDITION

32 Chapters of useful reference material on all practical aspects of radio communication on frequencies from 3.5 to 500 Mc.

Twelve chapters devoted to fundamentals of radio communication. Six chapters cover practical aspects of communication antennas and transmission lines. One chapter devoted to electrical and mechanical data on rotary arrays alone! Valuable new information on tuning of antenna arrays and on matching the antenna to the feed line.

Eleven chapters of constructional data on transmitters up to one kilowatt, receivers, broad-band and conventional converters, test equipment, exciters, v.f.o.'s, speech equipment and power supplies.

One chapter is devoted to a compilation of data on the calculation of operating characteristics of all usual types of vacuum-tube amplifiers, including grounded-grid, cathode-follower, and beam tetrode types. One chapter devoted to transmitter design and control principles, with examples of flexible transmitter-control circuits.

$3.00 at your radio parts dealer. If he cannot supply you, order direct from us. Add 10c postage; foreign, 25c. Clothbound, gold stamped.

RADIO AMATEUR NEWCOMER

The Only Comprehensive Book for the Beginner

You need no other book to get your license and get on the air. Ideal for those just getting started, or getting interested, in amateur radio.

- **How-to-build simple equipment for a complete station on all newcomers bands.**
- **Operating instruction. • Simple theory.**
- **Complete section of study questions, including those needed to pass the license exams.**
- **U. S. A. Amateur radio regulations. Written by the editors of the RADIO HANDBOOK.**

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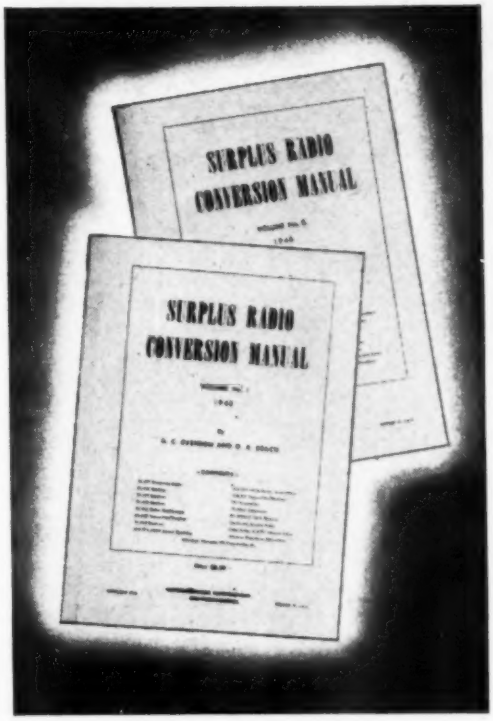

SURPLUS RADIO CONVERSION MANUAL

IN TWO VOLUMES

VOLUME I

BC-221 Frequency Meter
BC-342 Receiver
BC-312 Receiver
BC-348 Receiver
BC-412 Oscilloscope as a test scope or as a television receiver
BC-645 420-Mc. Transmitter/Receiver
BC-453A Series Receivers
BC-457A Series Transmitters
SCR-522 144-Mc. Transmitter/Receiver
TBY Transceiver with Xtal Control
PE-103A Dynamotor
BC-1068A V-h-f Receiver
Electronics Surplus Index
Cross Index of VT-Number tubes

VOLUME II

ARC-5 and BC-454 Rcvrs for 28 Mc.
ARC-5 and BC-457 Tx for 28-Mc. Mobile
ART-13 and ATC Transmitter
Surplus Beam Rotating Mechanisms
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Hi-Fi Tuner from BC-946B Rcvr
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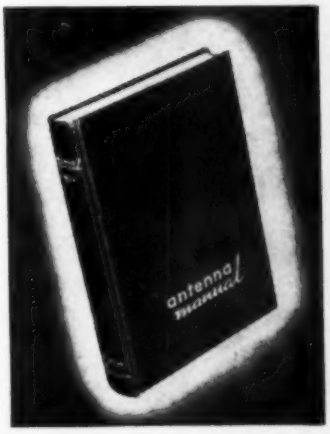

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maximum signal current) making a total of 2.6 amperes and the resulting bias voltage would be 20 ohms multiplied by 2.6 amperes or 50.2 volts.

The maximum variation in grid bias voltage between the limits of zero signal and assumed full signal would be only .4%, a negligible amount. From the foregoing it seemed that a rectifier-filter system delivering 50 volts d.c., having an apparent internal resistance in the order of 20 ohms, and having a low ripple content would adequately serve the purpose intended.

Requirements outlined indicated the use of a rectifier capable of relatively large current output at low voltage. Metallic oxide rectifiers are admirably suited for such purpose and two units of this type (as manufactured by *General Electric Company*) were selected. These rectifiers are bridge connected and, to insure adequate current carrying capacity, two are employed with the corresponding elements of each unit connected together.

The schematic diagram of the unit is shown in Fig. 2.

Choke CH_1 was made by winding some 300 turns of #18 d.c.c. wire on the core of a discarded receiver power transformer.

Relay RL_1 is a single pole, normally open, midget type, 117 volt a.c. relay with the original winding removed and replaced with a sufficient number of turns of # 18 d.c.c. wire to effect closure upon application of load of the two 32 volt, 25 watt lamps used as bleeder resistors and marked B_1 and B_2 in Fig. 2. Points of this relay are connected in series with the solenoid of the relay controlling application of plate voltage, thereby making impossible the application of plate power to the modulator unit until bias voltage is applied.

With the exception of the transformer marked T_1, the components were initially connected as shown by Fig. 2, but with the a.c. side of the rectifier connected through a rheostat to the 117 volt a.c. line and with an alternating current voltmeter connected to rectifier at a.c. terminals.

Rectifier voltage was varied by the rheostat until voltmeter M read 50 volts d.c. At this condition the a.c. voltmeter across the rectifier read 69 volts.

With the information thus obtained, a 75 watt transformer was designed and constructed to stepdown the 117 volt a.c. line power to 69 volts and all connections made as shown by Fig. 2.

The pilot light, PL_1 is mounted on the front of unit as is the voltmeter M.

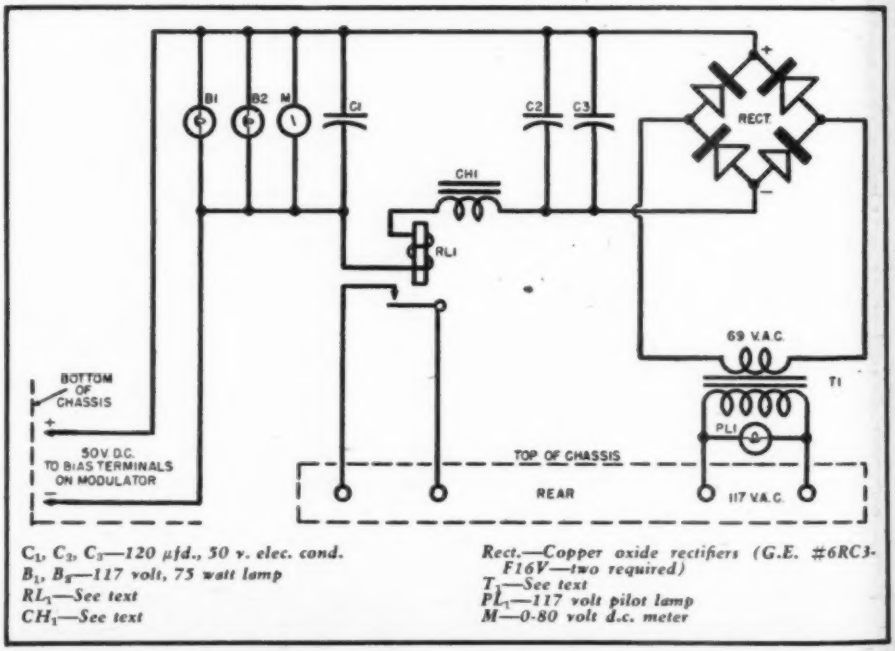
A photograph of this unit as installed in the writer's transmitter is shown by Fig. 1.

This unit has now been in operation approximately three years. To date the only maintenance required has been the replacement of the original 25 watt, 32 volt lamps which was occasioned by their operation at 50 volts. Recently, however, these lamps have been replaced by 75 watt, 117 volt lamps which will have a longer life expectancy because of under-voltage operation. With the 75 watt, 117 volt lamps, grid bias voltage remains constant at 50 volts irrespective of magnitude of modulator grid current. The restrictions which would be placed on the transmitter by failure of bias batteries has now been removed.

It has also been found that a wide range of bias voltages may be obtained by using different combinations of lamps of the same or different wattage ratings.

Range of voltages obtainable may be varied by the use of a rheostat or autotransformer in the 117 volt a.c. side of the line supplying transformer T_1, with regulation improving as bias voltage is increased. —30—

Fig. 2. Complete schematic diagram of grid bias supply.



C_1, C_2, C_3—120 µfd., 50 v. elec. cond.
B_1, B_2—117 volt, 75 watt lamp
RL_1—See text
CH_1—See text
Rect.—Copper oxide rectifiers (G.E. #6RC3-F16V—two required)
T_1—See text
PL_1—117 volt pilot lamp
M—0-80 volt d.c. meter

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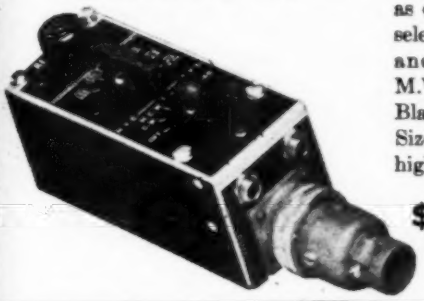

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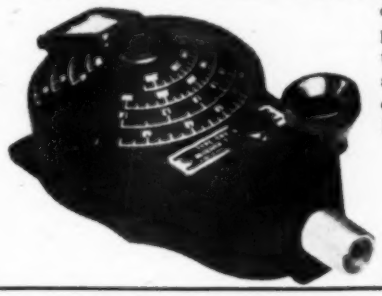

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About 6" diam. x 15" deep. Contains 1—5FP7, 1—6AK5 tubes, 5 grain-of-wheat 3 V. pilot lights, magnetic deflection yoke, condensers, resistors, potentiometers, sockets, etc.

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A complete 460 Mc. radio receiver and transmitter which can be converted for ham or commercial use. Tubes used and included: 4—12SH7, 3—12SJ7, 2—6H6, 1—VR-150, 2—955, 2—9004. Other components such as relays, 24 V. dynamotor, transformers, pots, condensers, etc. make this a buy on which you cannot go wrong. Complete in aluminum case 18"x7"x 7¼". **$8.95.** "Grain-of-Wheat Pilot Lights." Screw base with receptacle. Used for aircraft instrument illumination. Ideal for model makers, hobby-craft designers, etc. Brand new. Each—**$0.10.** Gross—**$10.00.**

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J-38 Telegraph keys, new.....**$.75**

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Brand new radio tubes (not surplus)

Each tube is individually beautifully boxed. Standard radio tube guarantee, backed by the manufacturer and also by Esse Radio Company.

45c Each

1A5GT	1T4	35W4
1L4	5Y3GT	39/44
1R5	7AF7	501

55c Each

1S5	12SR7	80
1U5	26	
3A4	35Z5GT	

55c Each

5W4GT	12BE6
5Y4G	12J5GT
6F6GT	12SA7GT
6J5GT	12SK7GT
6J7G	12SQ7GT
6K6	14X7
6Q7GT	35B5
6SA7GT	41
6SK7GT	50A5
6SQ7GT	50L6GT
6X5GT	50Y6
12A8GT	84/6Z4
12AT6	

55c Each

1A5GT	6U7G
1C5	6V6GT
1H5GT	6X4
1N5GT	6Z4
1P5GT	12BA6
1V	12F5GT
2A5	12J7GT
3Q4	12K7GT
3Q5GT	12K8GT
5U4G	12Q7GT
5X4	12SF5
6AC5	12SF7
6AC5GT	12SG7
6AQ5	12SJ7GT
6A8G	24A
6AT6	25L6GT
6AU6	25Z5
6A7	25Z6GT
6A8GT	35
6BA6	35L6GT
6BE6	35Z3
6C5	36
6C6	42
6C8G	43
6D6	45
6F5GT	47
6H6GT	51
6K7GT	57
6K8GT	58
6P5GT	71A
6SC7GT	75
6SP5GT	76
6SJ7	77
6U5G	78
6U6GT	85

89c Each

0Z4	1LE3
0Z4G	1LN5
6B8	7X7/XXFM
6F8	70L7GT
6T7G	117L7GT
6Q6G	117P7GT
6S7G	XXFM
6J8G	6L6G
7G7/1232	6L6GA
1LA4	7E5
1LA6	7K7
1LC6	2050
1LD5	

89c Each

1Q5	7C6
1T5	7C7
2A3	7H7
2A7	7Q7
5Z4	7Y4
6AC7	14A7
6B4G	14B6
6C8G	14Q7
6D8G	25AC5GT
6S8GT	25A7GT
7A4/XXL	35L7GT
7A7	117Z3
7B6	35Y4
7B7	117Z6
7C5	XXL

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Low-Cost MULTIMETER

Construction details covering an all-purpose multimeter for students and radio servicemen.

By ABE SIEGEL
Bradshaw Instruments Co.

IN DESIGNING an all-purpose multitester for the student and the radio serviceman, the primary considerations are versatility of operation and simplicity of control. In addition, the ideal instrument must be compact, portable, and low in cost.

All of these factors were carefully considered in the design of the *Bradshaw* Model 30 multitester, the commercial counterpart of the instrument described in this article.

First, the number of controls have been reduced to an absolute minimum. All of the ranges and functions are obtained with one rotary switch, one zero-adjust potentiometer, and three pin jacks. This system simplifies range selection considerably and reduces the possibility of error.

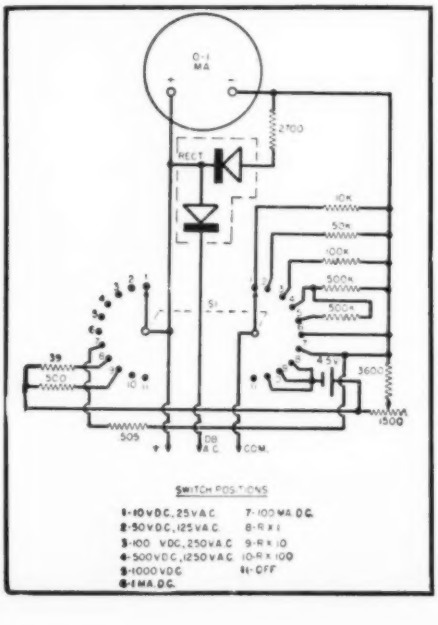
A 0-1 ma. 3½ inch round meter was selected for economy of space and its ability to withstand abuse. The rugged one mil movement will stand up under a fairly heavy physical shock and it can take considerable overload without damage.

A quick glance at the circuit diagram of Fig. 1 will show that the principle of simplicity has been adhered to closely. The same multiplier resistors are used for both the a.c. and d.c. voltage ranges. A two-element copper oxide instrument rectifier gives high input impedance on the a.c. ranges.

The front panel layout of the commercially-built instrument is shown in the photograph. The instrument is laid out in the long plane so that it may be used upright as well as flat on the test bench. A good arrangement is to place the instrument upright on a shelf at about eye level.

Front view of the commercially-built multimeter designed for servicing.

Fig. 1. Circuit diagram of the multimeter. All parts are standard and may be obtained from any radio parts supplier.



The battery used is the *Eveready* No. 751 which delivers 4.5 volts and is much more compact than the three flashlight cells normally employed in this type of circuit. The battery is mounted on the meter by means of a "U" shaped spring which can be fabricated from a piece of 22 gauge spring brass or phosphor bronze five inches long by one inch wide. The 100 ma. shunt is made of No. 28 *Driver-Harris* manganin resistance wire. The meter employed in this model has an internal resistance of 500 ohms and requires a shunt of .505 ohms, or exactly 3.35 inches of No. 28 manganin.

For any meter the required shunt resistance is one per-cent of the resistance of the meter movement and may be calculated accordingly.

No sub-assemblies other than the battery spring are required. The rectifier is mounted on the battery spring and all other components are mounted directly on the rotary switch.

This instrument provides the following ranges: 0-25, 0-125, 0-250, and 0-1250 a.c. volts; 0-10, 0-50, 0-100, 0-500, and 0-1000 d.c. volts; 0-1, and 0-100 d.c. ma.; resistance may be measured in three ranges covering 0-10,000, 0-100,000, ohms, and 0-1 megohm.

In addition, the a.c. voltage ranges are calibrated in decibels where zero level is .006 watts at 500 ohms. The db. level is read as follows. On the

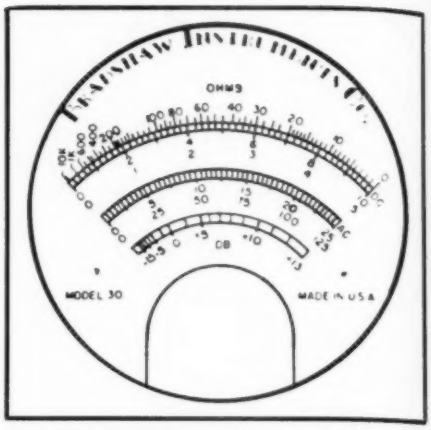


Fig. 2. Reproduction of meter scale used with commercially-built multimeter unit.

a.c. 25 v. range add 10 db. to decibel reading; on 125 v. range add 24 db.; on 250 v. range add 30 db.; and on 1250 v. range add 44 db. The db. scales provide a handy means of checking voltage gain of an audio system.

Fig. 2 is a reproduction of the meter scale used with this instrument. This scale is for a 0-1 ma. meter having a 90 degree arc.

—30—

Receiver Design

(Continued from page 56)

follows; with S_2 closed a bias of minus approximately three volts is applied to the grid of the second section of the 7F7. This bias voltage is also applied to the diode and the grid of the 7E7. Under these static conditions the gain of the 7E7 is maximum and there will be maximum shunting of the audio signal. When high frequencies are present a signal of sufficient amplitude to overcome the delay bias on the diode will cause current flow in the diode. The diode current flow will increase the bias on the 7E7 and reduce the gain. This reduction of gain reduces the input capacity and the high frequencies are allowed to pass.

A "B plus" voltage is applied to this circuit through S_1 when the receiver is switched to phono position only. S_2 is a front panel control and will disable the scratch eliminator circuit when turned to the open position. With this switch open minus 65 volts is applied to the second section of the 7F7, the diode and the reactance tube. This bias will cut off these tubes and since the gain of the reactance tube is zero it will have a minimum input capacity.

A view of the sub-chassis on which the 7F7 and 7E7 tubes are mounted is shown in Fig. 5. This sub-chassis was added to the main chassis which had already been incorporated in another model. Thus a minimum of changes were required on the original chassis.

These scratch eliminators have created a great amount of interest by supplying the listener of recorded music with a means of reducing the scratch without sacrificing fidelity.

(To be continued)

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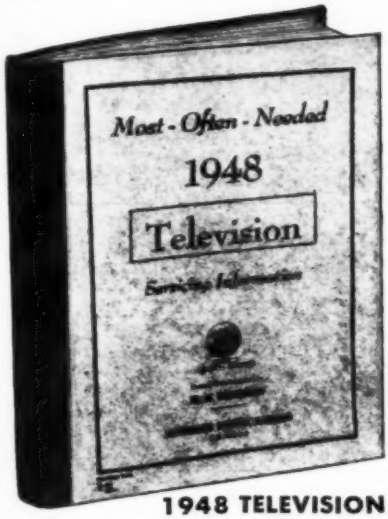

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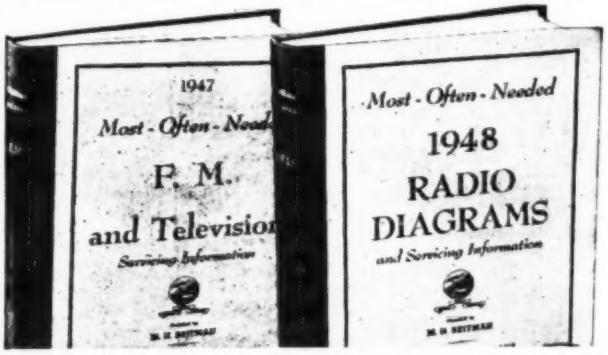

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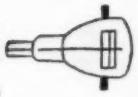

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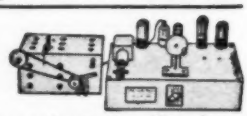

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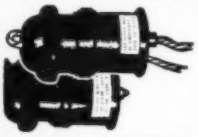

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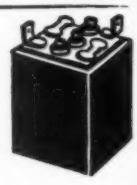

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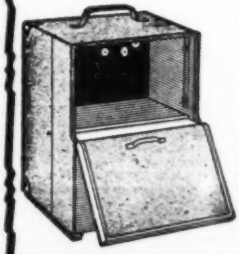

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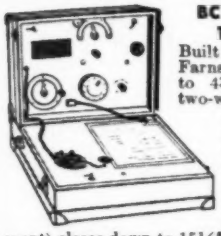

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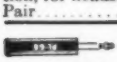

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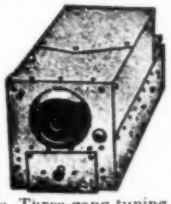

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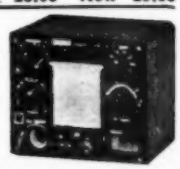

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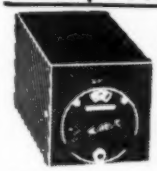

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Suitable for 400 Mc citizens' band, fine for UHF experimenters. 5¼" flat antenna rod, mounted on porcelain base, with mounting plate and right angle feed through. Brand new.
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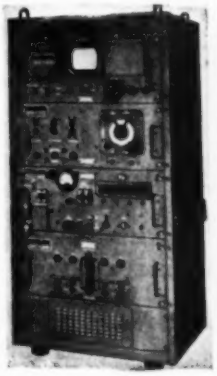
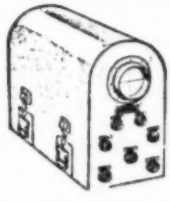


Bargain opportunity of a lifetime! This I.F.F. equipment originally cost about $20,000 . . . now buy it for a tiny fraction of cost! Easily converted for Television. Complete assembly consists of Control unit with 5" C.R. Tube, transmitter and receiver assembly (157 to 185 Mc). Indicator unit, and Power Supply (450 watts), operating on 110 volts, 60 cycles AC. All assembled, ready to operate. 62 Tubes included: 8—6V6GT, 9—6SL7GT, 14—6SN7GT, 1—5CP1, 2—9006, 1—6Y6G, 2—6E5, 1—100TH, 2—6J5, 2—2C26, 1—3E29, 1—6H6, 7—6AG5, 3—6AK5, 1—6C4, 3—2X2, 1—6X5GT, 3—5U4GT. Overall size 55" high, 28" wide, 20½" deep. Shpg. weight 855 lbs. Your cost complete, BRAND NEW, in original packing **$195.00**

BC-412 OSCILLOSCOPE Modified to BC-612



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Price only **$79.50**

LM-7 FREQ. METER

195 to 20,000 Ke modulated, complete with tubes and crystals, less power supply. Navy type, used, good condition. **$49.50**
Less calibration book.

PE-104-A VIBRATOR POWER SUPPLY

Works on 6 volt or 12 volt battery. Supplies 84 volts and 51 volts DC, also 1.4 volts "C" bias. Size 7"x4"x 3¾". Fits BC-654 (SCR-284) exactly. Can be used to operate many types of receivers now on market. ALL BRAND NEW.
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R-89/ARN-5A GLIDE PATH RECEIVER

332-335 Mc, complete with relays, 7—6AJ5, 2—12SN7, 12SR7, 28D7, 3 crystals, 6497, 6522, 6547 Ke. 90 and 150 cycle bandpass filters. Xtal-cont. local osc. Fine for making intermodulation checker; Broad band pass on 20.7 Mc ideal for Television. Entire unit housed in beautiful cabinet. This is a once-in-a-lifetime buy!
ONLY **$10.95**

LOOK AT THESE PM SPEAKER BUYS!

Alnico V, 4" PM, less trans.	$1.30
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Alnico V, 10" PM, with trans.	4.65

6V6—Midget Output Trans. 42c
50L6—Midget Output Trans. 42c
ACDC—Chokes 32c

Controlled Rectifier

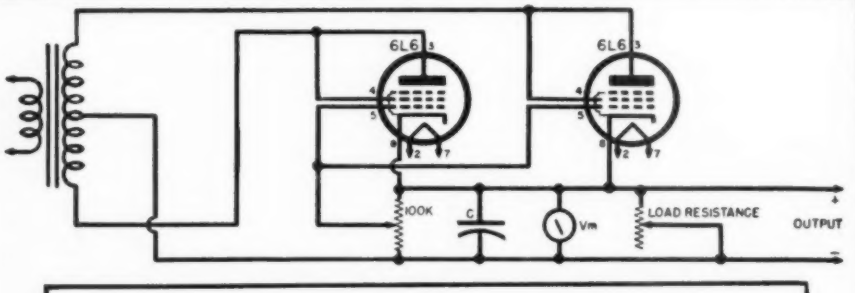
(*Continued from page 44*)

from those specified. Aside from the fact that the filter condensers should have voltage ratings suitable for the power transformer to be used, there is nothing critical about the values of the components used in this unit and the constructor can use junk box parts he happens to have on hand.

The unit illustrated features a controlled rectifier with variable output. The transformer ratio and the type of filter is entirely optional with the builder. The only critical item is the control potentiometer, shown in the schematic as a 100,000 ohm, wirewound *Clarostat* W-49 standard pot. This pot carries the full output voltage when it is advanced full-on. It should be either a 3 or 6 watt unit, depending upon the maximum output voltage. For a low voltage unit of, say, 200 volts, an ordinary carbon pot may suffice. However, experience has shown that it is better not to use carbon pots in this particular application.

For those who have 1625's (an extremely inexpensive surplus tube) plus a power transformer with a 12 volt or two 6 volt windings, an inexpensive power supply can be built. Those with plenty of 6L6's on hand may use these tubes in preference to the 6AS7G specified in the circuit diagram.

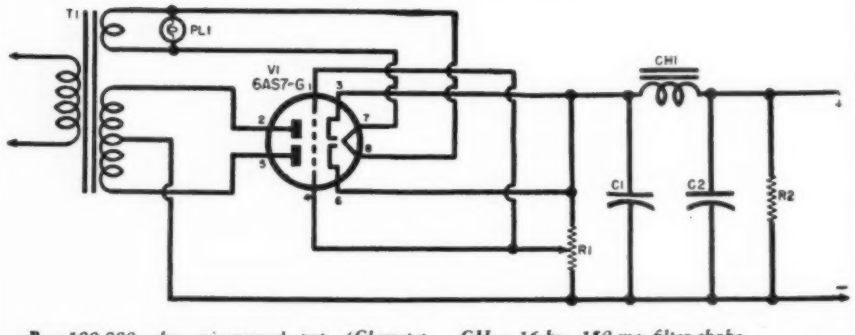
This controlled rectifier power supply features; simplicity and low cost, use of a single tube as both rectifier and control tube, smooth output control over a worthwhile range, no increase in ripple percentage as output voltage is lowered (typical of grid-phased thyratrons), no hash in output (typical of controlled rectifiers using gas tubes), and a certain measure of protection against overload due to the fairly high impedance of the rectifier



Tube	Range of D.C. Output Voltage	Range Ratio	Load Res.
6AS7G	145-396	2.7:1	14,200 ohm
	140-382	2.7:1	6300 ohm
	135-362	2.7:1	2350 ohm
	120-338	2.8:1	1450 ohm
Pair of 1625's	52-360	6.9:1	14,200 ohm
	49-321	6.6:1	6300 ohm
	45-293	6.5:1	2350 ohm
	43-263	6.1:1	1450 ohm
Pair of 6L6's	57-362	6.3:1	14,200 ohm
	52-325	6.3:1	6300 ohm
	48-266	5.6:1	2350 ohm
	45-230	5.1:1	1450 ohm

Fig. 2. Test data shows performance of various tubes that may be used in the design of the controlled rectifier. Diagram shown was the one used to obtain this data.

Fig. 3. Complete schematic diagram of controlled rectifier power supply.



R_1—100,000 ohm wirewound pot. (Clarostat W-49 or equivalent)
R_2—25,000 ohm, 15 w. wirewound res.
C_1, C_2—16 µfd., 450 v. elec. cond.
CH_1—16 hy., 150 ma. filter choke
T_1—Power trans. 325-0-325 v. @ 150 ma.; 6.3 v. @ 3 amps.
PL_1—Pilot lamp
1—6AS7G tube

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DESIGNED FOR FIELD SERVICE

VERTICAL AMPLIFIER TO 5 MEGACYCLES

PERFORMANCE DATA

DEFLECTION SENSITIVITY—
Direct to Vert. Amp. Input .1 v RMS
Direct to Hor. Amp. Input .14 v RMS

VERTICAL AMPLIFIER—
Sine Wave frequency response: Plus or minus 2 db. 5 cycles to 5 mc. down 6 db. at 7 mc.
Gain Control: Independent of frequency within range of the amplifier.
Phase shift: Less than 1° at 60 cycles (overall).
Square wave response: 30 cycles to 150 kc.

HORIZONTAL AMPLIFIER—
Sine Wave frequency response: Plus or minus 2 db. 5 cycles to 1.5 mc. down 6 db. at 2 mc.
Gain Control: Independent of frequency within range of the amplifier.
Phase shift: Less than 1° at 60 cycles (overall).
Square wave response: 30 cycles to 50 kc.

Z AXIS AMPLIFIER—
Sine Wave frequency response: Plus or minus 2 db. 100 cycles to 100 kc. down 6 db. at 150 kc.

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when operating at reduced output voltage.

It might be mentioned that the simplicity of the self-bias scheme does not permit an infinite control range. The extreme simplicity of the scheme does, however, make it worthwhile to build up this unit. It is entirely possible to provide a separate bias supply of suitable level to completely cut-off the controlled rectifier and thus obtain a supply adjustable from zero to full voltage. Such a supply would, unfortunately, cease to fall in the class of simple and inexpensive power supply units. —30—

QUICK CHECK FOR SERIES FILAMENT TROUBLE

By HUGH LINEBACK
Asst. Prof., Oklahoma A. & M.

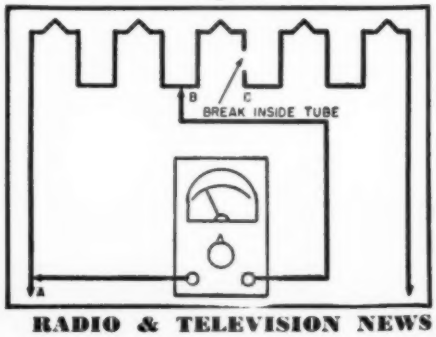
A SERIES filament circuit in a receiver is about the simplest hook-up in the set, but it often causes some of the most baffling troubles. For instance, in the case of the intermittent tube which tests good when cold, but opens the circuit when it warms up, it is difficult to locate the offending tube, as they all go dead at the same time. By the time an ohmmeter test is made the circuit will probably be closed again, and in any case a little judgment is required to interpret the readings as the filament resistance changes with different values of current. The following simple check with a multimeter is made with the receiver under operating conditions.

Set the meter to cover the total voltage applied across the filaments, noticing, of course, whether a.c. or d.c. is used. Connect one test lead to the first filament connection, as at point *A* shown in Fig. 1. Then move the other test prod successively down the line of filament pins. In the case shown there will be no voltage at any of the pins through the one marked *B*, but when pin *C* is touched, practically full voltage will be indicated. Thus it is quickly shown where the break has occurred.

The same procedure is useful when all tubes have continuity but the trouble is hidden in a bad joint or socket prong.

The theory behind this handy method will be remembered from Ohm's Law, which shows that no voltage will be lost across the tubes when there is no current flowing through the circuit. ($E = IR$). Therefore, since the meter current is negligible and there is no drop across the tubes, full voltage appears at the break. As soon as the trouble is corrected and normal current flows, the proper voltage will be lost across each tube. —30—

Fig. 1



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No. 34N22563R—same as above, mounted in handsome walnut and maple base, **$34.99**

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SLIDE RULE DIAL
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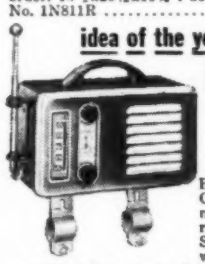
idea of the year



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Law Upholds Landlord on TV Antennae

Under the law, landlords appear to be within their rights in refusing permission for erection of antennae by apartment tenants. They may ban aerials entirely, or give permission to some residents and bar others, without being held answerable to those who are denied this favor. Courts have held that the rental of an apartment does not give the lessee any proprietary right to attach any equipment to a roof or the other exterior parts of a building.

The property owner also is held to be within his rights in removing an aerial which has been set up without his permission, provided he takes the precaution of returning the equipment intact to the tenant in his building.

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100 mi 10H..... 59c

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AN/PRS-1 MINE DETECTOR—BRAND NEW $9.50

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Contains power supply 110 V. 400 cycles, has 7 tubes such as 3CP1, brand new, complete with tubes. Each $17.95; Used, F.O.B. Chicago, only, each $14.95

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Has 45 tubes, one 5" scope tube, one 2" scope tube, has 3 meters, 4 power supply units 110V 400 cycles complete with tubes. F.O.B. Chicago, only, Each..... **$39.50**

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6H6GT/G	49c	211	.69	5BP1	1.39	9005	.49
6SS7	72c	12SN7	.49	5FP7	1.39	9006	.49
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Each section 38" long, screw together as follows: MS-49 (tip section) into MS-50, MS-50 into MS-51, MS-51 into MS-53 into another MS-53 or into the mounting base. Make as long into the mounting base. Make as long as you as you please by adding MS-53's. BRAND NEW, per section 35c

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Self-excited, delivers 450 vdc, 100 MA, driven by 18v dc or ac. Long shaft, gear. New, less dust covers on ends. F.O.B. Chicago, only..... $1.89

BEST SURPLUS BUY OF THE YEAR

Receiver, converts to 2, 6, 10 and 11 meters, plus 88-108 mc AM/FM, plus xtal-controlled freq. meter! Independent front-panel dial control for each of 4 rf & osc tuning sections working into a single 2.85 mc IF strip. Self-contained xtal calibrator/heterodyne freq. meter gives choice of 1000 or 100 kc check points incorporating a locked-in multivibrator exceptionally rich in harmonics, used both for transmitter and receiver calibration. For home or mobile or for new aviation VHF channels. Complete with 4" panel speaker, 12v dynamotor and lab-standard 1000 kc xtal. Used, excellent condition, **with schematic and complete conversion instructions.** F.O.B. Los Angeles, only $34.95

HEADSET SPECIAL HIGH-IMPEDANCE UNIT R14

Convert your low-impedance headset to high-impedance. HS-23 by switching to R14 receiver units. New, per pair. F.O.B. Los Angeles, only **69c**

A SWEET OSCILLOSCOPE DEAL

ASB-7 Radar Indicator Unit: For conversion to test scope or for use as modulation monitor. Has standard test-scope CR tube, H Cent, V Cent, Bril, Foc, Gain, and range selection switch. External power source was used. Tubes: 4-6AC7, 3-6H6, 1-5BP1. Condition: used, excellent. LOOK AT THIS PRICE; F.O.B. Los Angeles, only **$9.95**

RADIO SCHOOL SPECIAL

BD-57-A code practice switchboard. Has built-in motor alternator supplying 400 cycle tone for up to twenty student positions. All cords and plugs supplied. F.O.B. Chicago, only **$12.50**

RADAR TRANSMITTERS

ASB-7: Airborne search unit, 0-70 miles, 515 mc. External power supply was used. Condition: used, excellent. F.O.B. Los Angeles, only..... $12.95

BC-702-A: 175 mc using hollow tuned lines in push-pull circuit. Fan cools the hollow lines, forces air through them. Lengthen lines and you're on 2 meters. Including Weston meter, and at a price which justifies experimenting. Less RF tubes. Brand new. F.O.B. Los Angeles, only..... **$4.95**

All shipments F.O.B. Chicago or Los Angeles unless specified. 20% Deposit required on all orders. Minimum order accepted $5.00. California and Illinois residents, please add regular state sales tax to your remittance.

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MICROPHONE BUY

T-24: Hand-held mike, carbon, with push-to-talk switch, brand new, far superior to older styles. SPECIAL. F.O.B. Los Angeles, only **79c**

24,000 OHM HEADSET

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Condenser, Pyranol 2 MFD, 4000 V... **$4.95**
Command Transmitter BC-457, brand new, 4 to 5.3 mc $7.95

RA-87: Rectifier, selenium, input 95—125V or 190-250V, 50-60 cy. Output 115 V dc, 400 ma and 115V ac, 4.35 A. Used, excellent.....$14.95

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ANB Receiver: Low-impedance, magnetic type use as under-pillow speaker.
New, each..... **39c**

T-26/APT-2

Radar jamming transmitter, 450-710 mc. Helsing amp.-mod. by noise from 931A photo-tube. Output 3 to 7 watts. All controls on front panel. 2—6AC7 and 1—6AG7 video circuit supply random noise, with pass band of 20 kc, to 4 mc, to the 807 mod. 2—368AS tubes in a push-pull ¼-wave transmission-line osc. circuit supply the RF. Power furnished by 2—5R4GY and 1—2X2 tube. Contains 27vdc blower. Input 27vdc and 75-85v or 105-125v, 400 to 2600 cy. Brand new in original export case, with all tubes and handbook. Don't let this get away from you—Order today! F.O.B. Chicago, only. At only..... **$9.95**

T-27/APT-3

Another noise-modulated radar jamming transmitter, companion to the APT-2, 85-135 mc. Power output 9 to 12 watts, M.O.P.A. type transmitter. Built with 4 demountable sub-chassis: R.F. Osc.; R.F. Amp.; photoelectric noise source, video amplifier and modulator; power supply. Tubes are: 1—829B RF Amp., 1—832 RF Osc., 1—931A phototube, 2—6AC7 video amp, 1—6AG7 mod., 1—5R4GY rectifier. Brand new, in original export case, with all tubes and handbook. F.O.B. Chicago, only..... **$10.95**

AN/APT5 ULTRA HIGH-FREQUENCY TRANSMITTER Brand New

400-1500 Megacycle Transmitter, made for U.S. Govt., complete with the following tubes: 2—6AC7, 1—6L6, 2—829, 1—931A, 1—6AG7, 1—522 Ultra high freq. tube. Complete with high freq. cavity, 1 blower to cool the 522, 1 time delay relay, 2 filament trans. cond. and many other component parts for ultra high frequency work. It has a frequency checker, complete Lecher wires, with slider and sensitive bulb for checking the wave length. Operates on 115V. AC for filaments only. Does not include any plate supply. The tubes alone are worth many times more than what we are selling the complete transmitter for. Packed in original case—contains instruction book. Wt. 118 lbs. **$49.95**
F.O.B. Chicago, only.....

RADAR ANTENNA

AS-69; fish-hook type radar antenna assembly; can be used with APT-2, APT-3 and APT-5. NEW. F.O.B. Chicago, only..... **$2.95**

ALTIMETER TRANSCEIVER RT-7/APN-1

Frequency 418-462 Mc FM, with 14 tubes: 3—12SJ7; 4—12SH7; 2—12H6; 1—VR150; 2—955. 2—9004; 27 V. Dynamotor, used in working condition .. **$7.95**

RECEIVER-POWER SUPPLY UNIT

For the APN-4 indicator; complete with 16 tubes, 110 V, 400 cycles.
BRAND NEW **$10.95**

AN18/APT-10

Pre-amplifier Model K-1, designed to raise output level of magnetic type microphone, complete with 2 tubes 6SL7GT and 2SD7 and hand switch, brand new in original cartons.
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Provides amplification of information from Flux Gate Compass to drive torque unit and differential gear of azimuth differential unit CN-4/APA-14. Input 26 VDC and 115 V; 400 cy. Part of stabilization assembly AN/APA-14. With plugs, 2—6SN7-GT; 2—6H6, transformer, oil-filled condensers, pots, etc.
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Ideal for indicating direction of antenna systems—BRAND NEW .....each **$2.95**

COMMAND SET SCR-274 MEDIUM FREQUENCY

Excellent condition. F.O.B. Chicago, only **$29.95**
Complete installation with 2 transmitters, 3 receivers, racks, tubes, crystals control box and plugs.

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(274N Series)—Complete with Tubes

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BC-450—Triple receiver control box, can be modified to a FT-260 local control for command receivers, NEW..... **$1.95**

BC-1206-C BEACON RADIO RECEIVER

Designed to receive A-N beam signals. 24-28 VDC 21.6 watts. Tube complement: 14H7 or 14A7, RF amplifier; 14H7 or 14J7, mixer; 14A7 or 14H7, IF amplifier; 14R7, detector and 1st audio amplifier; 28D7, output amplifier. 195 to 420 kc. 4" high x 4" wide x 6⅝" long—wt. 3 lbs., 4 oz.
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ANTENNA THERMO-COUPLE METER

BC-442; 0-10 amps, with extra relay and 50 MMFD 5000 Volt condenser . . . used with command transmitters. BRAND NEW..... **$1.95**

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The complete amplifier includes one rect. 7Y4, 3—7F7's for amplification and control, 3—7N7's for signal discrimination, 1 power transformer, 6 relays, 4 control pots, chokes, condensers, etc. Convert for use on radio controlled models, doors, etc. Operates from 24 V. DC. Size: 9½x6¾x7-5/7". Complete. NOTE: Tubes good for television sets. Used—good condition. F.O.B. Chicago, only **$4.95**

SELSYN METER TO INDICATE POSITION C-71A/APQ-13

Contains 2" meter, FS-100uA, Weston 506, 0-300 V, 0-30 MA, with 6 precision resistors, as external multipliers and shunts; toggle switches, push switches, rotary switch, pots, knobs, etc. GOOD CONDITION. F.O.B. Chicago, only **$4.95**

SCR-522 CONTROL UNIT

BC-602-B, brand new, export packed, 1 "off" push-button switch, 4 channel-selecting push-button switches, 5 pilot lamp assemblies with pilot bulbs and film dimmer and lever switch with locking control. With Schematic **98c**

RECEIVER-TRANSMITTER BC-620

FM Mobile Transmitter-Receiver operates from 6 volt vibrapack, 20.0 to 27.9 Mc; easily converted to 10-meter freq. 28-29.7 Mc.
New. F.O.B. Chicago, only.....$14.95
Used. F.O.B. Chicago, only..... 9.95
OUTPUT TRANSFORMER: 10 assorted ouncers for $1.89

2-METER TRANSMITTER SCOOP!

The famous AN/ARC-5 VHF Transmitter (T-23/ARC-5), brand new 100-156 mc but less tubes, crystals, and the holders for the 832A tubes. Furnished with complete schematic, 4 Xtal-controlled channels selected by 3 motor-driven turrets. Motor can be spun by hand for manual band switching or driven by low-power rectifier power pack. Tubes required are 2—1625 and 2—832A. Don't pass this up at ONLY..... **$4.95**

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6 or 12 volt input; output 145 volts and 90 volts; less vibrator, voltage regulator and rectifier tube; ideal mobile power supply unit; excellent condition. F.O.B. Chicago, only, each **$2.95**

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PE-55Dyn. Unit: 12v in, 16 amp, 500v out, 200 ma. F.O.B. Chicago, only.....$3.75
PE-206 Inverter Unit; rotary converter, 28v in, 80v at 500 VA, 800 cy. out. F.O.B. Chicago, only.....$3.95
DM32A—each.....95c 3 for $2.00

OUTPUT TRANSFORMER

Hi-Fi; used is Scott-made Navy receiver. Fully potted. Pri. 5000 ohms, output secondary 600 ohms CT, inverse-feedback secondary 60 ohms CT. ONLY **$1.49**

R-89/ARN-5A

Glide path receiver. Crystal control of local oscillator, 332-335 mc, complete with relays, 7—6AS5, 1—12SR7, 2—12SN7, 1—28D7, and 3 crystals: 6497 kc, 6522 kc, 6547 kc. 90-cycle band-pass and 150-cycle band-pass filters, excellent for making an intermodulation checker. Beautiful cabinet and chassis as foundation for many interesting experimental and construction projects. Broad pass band on 20.7 mc IF's ideal for television. Schematic furnished.
Used, excellent. Only..... **$6.45**
New $12.95

BC-733-D

Localizer receiver of the blind landing system. Companion to the glide path receiver. Also contains 90 and 150 cycle band-pass filters, 108.3 to 110.3 mc, by relay selection of crystals in the local oscillator. Wide pass-band on 6.9 mc IF's ideal for FM. Has a wonderful AVC system using rectified output of an RF oscillator as power supply for 100 volt DC bias. With relays, crystals, and 10 tubes: 3—717A, 2—12SG7, 1—12SQ7, 1—12A6, 1—12-AH7, 2—12SH7. Schematic furnished! Condition: Used, excellent, F.O.B. Chicago, only **$3.95**
New F.O.B. Chicago, only.....$9.95

VEEDER-ROOT METER AND CASE

Counts up to 1000,
F.O.B. Chicago, only. Each..... **59c**

HAND-TYPE MICROPHONE RS-38

Carbon type, with PL-68 plug, brand new...$1.95
Used 1.00

BC-645 TRANSMITTER-RECEIVER

BRAND NEW . . . 13 tubes interrogator-transmitter designed for airborne use, 435 to 500MC frequency range. With some modifications the set can be used for 2-way communication, voice or code, on the following bands: ham band: 420-450mc; fixed and moblie: 450-460mc; citizens radio band: 460-470mc; television experimental: 470-500mc; complete with all tubes, including WE Doorknob tube. Size 10½x13½x4¾". Net wt. only 25 lbs. Your cost.....only **$9.95**
DYNAMOTOR FOR ABOVE Model PE-101-C $2.75

RADIO PARTS

Assorted Bypass Condensers, 400-600WV .....100 for **$4.29**
100 Resistors ½ to 1 watt..... **95c**
Electrolytic condensers 50-30, 150 Volt.....10 for **$2.89**
½ and 2 Meg. Volume Controls 1" shaft with switch, each 39c 10 for.. **3.00**
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Crystal Pick-up, new light wt.....each **1.79**
Heavy Duty 12" PM Speaker, NEW .....each **5.95**

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Webster Record Changer

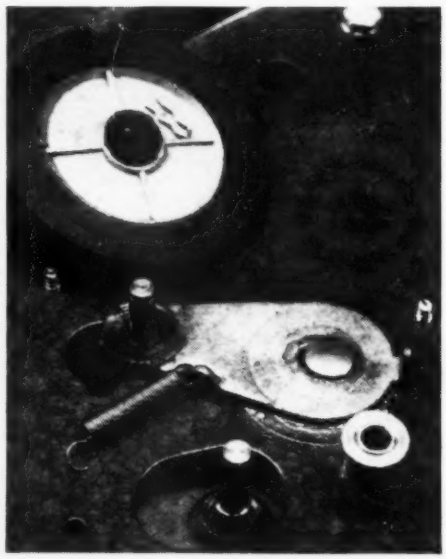
(*Continued from page 39*)

plate from the motor and clean all metal chips from the shaft, felt, and bearing. Upon reassembly of all the parts, the speed conversion is complete.

In order to return to 78 r.p.m., a motor pulley with a smaller-diameter shaft hole must be provided. If a lathe or services of a machinist are not available, a reasonably satisfactory bushing can be made for the old pulley from several turns of a ½-inch strip of heavy aluminum foil, such as may be obtained from a discarded electrolytic condenser. The hole must be perfectly concentric, or disagreeable flutter will be heard when playing records at 78 r.p.m.

The final step is the installation of the Microgroove pickup. Mounting dimensions of the particular pickup arm used, and the size of the player base must be considered when selecting the location. Fig. 1 shows a *Shure* Model 900MG pickup mounted on a *Webster* 56 changer. The position shown is the only one in which the pickup mounting hole could be located the specified distance from the turntable center, and still have no part of the pickup arm project beyond the edges of the player base. This particular pickup was intended to be used with the turntable surface a considerably greater distance above the mounting plate than that of the *Webster*. This results in improper tracking unless a stack of four or five records is placed on the turntable under the record being played. The extra weight of these records helps to stabilize the rotation speed and also permits the MG pickup to engage the beginning of a 12-inch record, otherwise prevented by interference of the crescent assembly at

Fig. 2. Detail view of drive parts showing idler wheel removed from shaft, enlargement hole in baseplate, reduced diameter motor shaft, and motor pulley with aluminum foil bushing. See text for details.



Mycalex Socket for 813, 4E27/257B Type Tubes..... 59c Ea.

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1 K.W. POWER SUPPLY KIT

2500-0-2500 Volts @ 500 MA
or
2000-0-200 Volts @ 500 MA
(oil-filled Xformer from BC610) ..$39.95

1—Swinging choke	14.95
1—Smoothing choke	7.95
1—Filament Xformer	9.95
2—2 Mfd.—3000v Condensers, each	3.45
2—872A Tubes...each	1.95
2—Plate Caps for 872A...each	.20
2—Sockets for 872A...each	1.19
2—Hash Filter Chokes...pr.	.79

All Parts New! Reduced to **$79.50**

SELENIUM RECTIFIERS
Full Wave Bridge Type

INPUT	OUTPUT		
up to 18v AC	up to 12v DC	½ Amp.	$0.98
up to 18v AC	up to 12v DC	1 Amp.	1.95
up to 18v AC	up to 12v DC	3 Amp.	3.45
up to 18v AC	up to 12v DC	5 Amp.	4.45
up to 18v AC	up to 12v DC	10 Amp.	7.45
up to 18v AC	up to 12v DC	15 Amp.	9.95
up to 18v AC	up to 12v DC	30 Amp.	14.95
up to 36v AC	up to 28v DC	1 Amp.	3.45
up to 36v AC	up to 28v DC	5 Amp.	7.45
up to 36v AC	up to 28v DC	10 Amp.	12.45
up to 36v AC	up to 28v DC	15 Amp.	18.95
up to 115v AC	up to 100v DC	.25 Amp.	2.95
up to 115v AC	up to 100v DC	.6 Amp.	6.95
up to 115v AC	up to 100v DC	5 Amp.	19.95
up to 115v AC	up to 100v DC	3 Amp.	12.95

OIL CONDENSERS
NATIONALLY ADVERTISED BRANDS
All Ratings D. C.

2x.1mfd.	600v	$0.35	1mfd.	2000v	$0.95
.25mfd.	600v	.35	2mfd.	2000v	1.75
.5mfd.	600v	.35	4mfd.	2000v	3.75
1mfd.	600v	.35	15mfd.	2000v	4.95
2mfd.	600v	.35	4mfd.	2500v	3.98
4mfd.	600v	.60	2mfd.	2500v	2.49
8mfd.	600v	1.10	.1mfd.	2500v	1.25
10mfd.	600v	1.15	.25mfd.	2500v	1.45
3x.1mfd.	1000v	.45	.5mfd.	2500v	1.75
.25mfd.	1000v	.45	.05mfd.	3000v	1.95
1mfd.	1000v	.60	.1mfd.	3000v	2.25
2mfd.	1000v	.70	.25mfd.	3000v	2.65
4mfd.	1000v	.90	1mfd.	3000v	3.50
8mfd.	1000v	1.95	12mfd.	3000v	6.95
10mfd.	1000v	2.10	2mfd.	4000v	5.95
15mfd.	1000v	2.25	1mfd.	5000v	4.95
20mfd.	1000v	2.95	.1mfd.	7000v	2.95
24mfd.	1500v	6.95	3mfd.	4000v	6.95
.1mfd.	1750v	.89	2mfd.	3000v	3.45
.1mfd.	2000v	.95	2x.1mfd.	7000v	3.25
.25mfd.	2000v	1.05	.02mfd.	12000v	9.95
.5mfd.	2000v	1.15	.02mfd.	20000v	11.95

HIGH CAPACITY CONDENSERS

10,000 mfd.—25 WVDC	$6.95
2x3500 mfd.—25 WVDC	3.45
2500 mfd.—3 VDC	.39
3000 mfd.—25 WVDC	2.49
2x1250 mfd.—10 VDC	1.25
1000 mfd.—15 WVDC	.99
200 mfd.—35 VDC	.59
100 mfd.—50 WVDC	.49
4x10 mfd.—400 VDC	.89
4000 mfd.—18 WVDC	1.95
4000 mfd.—25 WVDC	2.95
4000 mfd.—30 WVDC	3.25

FILTER CHOKES
HI-VOLTAGE INSULATION

8 hy @ 550 ma.	$7.95	325 hy @ 3 ma.	$3.45
8 hy @ 300 ma.	3.95	1 hy @ 800 ma.	14.99
25 hy @ 160 ma.	3.49	10 hy @ 250 ma.	2.45
12 hy @ 050 ma.	2.25	10 hy @ 200 ma.	1.98
30 hy @ 70 ma.	1.39	10/20 @ 85 ma.	1.59
.05 hy @ 15 amps.	7.95	15 hy @ 125 ma.	1.49
.1 hy @ 5 amps.	6.95	15 hy @ 100 ma.	1.39
4 hy @ 600 ma.	5.95	3 hy @ 50 ma.	.29
200 hy @ 10 ma.	3.49	30 hy Dual @ 20 ma.	1.49
600 hy @ 3 ma.	3.49	8/30 hy @ 250 ma.	3.50
.065 hy @ 2.5A	2.49	10 hy @ 100 ma.	1.29

RADIO TUBES

NEW!—STANDARD BRANDS!

1B24	$22.95	800	$1.69	1Q5GT	$0.99
1B26	4.95	801A	.49	1R5	.79
1B29	.89	802	2.95	1S4	.69
1N21	.59	803	5.95	1S5	.59
1N23	.59	805	3.95	1T4	.59
1N34	1.60	807	1.19	3Q4	.59
1P24	.89	808	2.25	3Q5	.69
2AP1	2.95	809	1.98	3S4	.59
2C22	.29	810	6.25	5Y4GT	.55
2C26	.29	811	1.49	6A7	.59
2C40	.89	812	1.98	6A8GT	.59
2C44	1.39	813	5.25	6AG5	.79
2C46	4.95	814	3.49	6AG7	.98
2D21	1.59	815	1.75	6B4G	.95
2J21	12.95	816	1.19	6BG6G	1.49
2J22	12.95	826	.49	6C6	.49
2J26	12.95	829B	4.95	6D6	.49
2J31	14.95	832A	3.45	6F5GT	.52
2J32	18.95	833A	29.50	6F6GT	.49
2J36	24.95	836	1.49	6F6	.59
2J37	18.95	837	1.49	6H6GT	.39
2J38	18.95	838	2.95	6J5GT	.42
2J39	18.95	841	.49	6J5	.55
2J40	18.95	843	.39	6J7GT	.55
2J46	18.95	845	3.49	6K6GT	.49
2J49	34.95	851	17.95	6K7GT	.49
2J51	69.50	860	1.98	6L6G	.95
2J54B	18.95	861	14.95	6L6	1.29
2J55	18.95	865	.79	6L7	.79
2K25	24.95	866A	.85	6Q7GT	.55
2K28	14.95	866JR	1.10	6SA7GT	.49
2V3G	.98	869B	29.95	6SC7	.55
2X2	.59	874	.69	6SF5GT	.59
3AP1	2.95	876	.39	6SH7	.49
3BP1	2.49	878	1.98	6SJ7GT	.49
3B22	.59	884	.79	6SK7GT	.49
3B24	.59	885	.79	6SL7GT	.69
3B26	1.95	902P1	5.95	6SN7GT	.59
3CP1	2.95	905	4.95	6SQ7GT	.49
3C22	19.95	923	.89	6V6GT	.59
3C23	2.49	954	.35	6X5GT	.59
3C24	.59	955	.35	7A8GT	.69
3C30	.59	956	.45	7B7GT	.59
3C31	1.49	957	.35	7C5	.59
3DP1	2.49	958	.35	7C6	.59
3D21A	2.95	1611	.98	7F7	.49
3E29	3.49	1613	.75	7Y4	.49
4B24	2.25	1616	.98	12A8GT	.63
4E27	12.95	1619	.29	12AT6	.49
5AP4	4.95	1622	1.59	12AU6	.59
5BP1	1.98	1624	.98	12BA6	.59
5BP4	4.95	1625	.49	12BE6	.59
5CP1	3.95	1626	.25	12J5GT	.49
5D21	18.95	1629	.25	12J7GT	.49
5FP7	1.49	1630	3.95	12K7GT	.49
5JP1	11.95	1638	.79	12Q7GT	.59
5J29	18.95	1654	1.98	12SA7GT	.49
5J30	18.95	1851	.89	12SF5GT	.49
5LP1	11.95	2050	.75	12SF7GT	.59
5U4GY	.89	2051	.75	12SJ7GT	.49
5T4	.98	8005	2.95	12SK7GT	.49
5U4G	.49	8011	.69	12SQ7GT	.49
5V4	.75	8012	1.98	12SR7GT	.49
5X4	.59	8013	2.69	14A7	.69
5Y3	.35	8014	6.95	14B6	.69
5Z3	.55	8016	1.89	14Q7	.69
5Z4	.79	8020	2.95	24A	.49
6AB7	1.05	8025	4.89	25L6GT	.49
6AC7	.59	9001	.39	25Z5	.47
6AK5	.89	9002	.39	25Z6GT	.45
6AL5	.69	9003	.39	26	.49
6C4	.25	9004	.39	27	.49
6D4	1.29	9005	.39	30 Spec.	.39
6J4	3.95	9006	.39	32L7GT	1.19
6J6	.89	CK1005	.29	35/51	.59
6Q5G	1.25	CK1006	.69	35A5	.59
7LP4	17.95	CK1090	1.49	35L6GT	.49
10Y	.39	EF50	.50	35W4	.38
12A6	.25	F123A	12.95	35Y4	.69
12DP7	14.95	F127A	17.50	35Z3	.57
12GP7	14.95	F128A	69.50	35Z5GT	.39
15E	.89	F660	39.50	36	.79
16R	.89	FG81A	4.95	41	.52
75TL	3.49	FG105	7.95	42	.49
100TH	9.95	FG238B	39.50	43	.52
211	.75	GL146	10.95	45	.52
227A	3.95	GL605	39.50	45 spec.	.39
231D	1.49	GL697	29.50	47	.74
249C	1.75	HY75	1.25	50A5	.89
250TH	19.50	HY615	.49	50B5	.59
304TL	1.49	ML100	29.50	50L6GT	.49
304TH	6.95	ML101	39.50	50Y6GT	.59
316A	.69	ML502	99.50	56	.54
327A	4.95	VR75	.89	59	.95
350B	1.95	VR90	.69	70L7GT	1.29
368AS	2.95	VR105	.69	71A	.59
371B	1.49	VR150	.69	75	.52
450TH	29.95	VT127A	2.49	76	.49
527	8.95	VU111	.49	77	.49
531	4.95	0Z4	.59	78	.49
559	1.29	1A5GT	.49	79	.85
703A	2.95	1A7GT	.59	80	.35
705A/8021	1.95	1H5GT	.54	81	1.55
706CY	18.95	1N5GT	.59	82	.89
714AY	6.95	1LA4	.95	83	.89
715B	8.95	1LA6	.95	83V	.89
715C	18.95	1LB4	.95	84	.59
717A	1.89	1LC6	.95	89	.69
721A	.59	1LD5	.95	117L7GT	1.15
723A/B	5.95	1LE3	.95	117P7GT	1.15
724A/B	1.95	1LH4	.79	117Z3	.49
725A/B	7.45	1LN5	.79	117Z6GT	.69
726A	6.95				

All Tubes guaranteed, except for open filaments, shorts and broken glass, for which we check before shipment. Please specify how to ship, ie: Parcel Post, Railway Express, etc.

500 WATT POWER SUPPLY KIT
(Ideal for BC-191 and BC-375E)

1—TRANSFORMER Pri: 105/250v-60 cyc in 5v steps Sec: 1120-0-1120 @ 500 ma. 2.5v CT @ 10 amps. 12v CT @ 14 amps. 17v CT @ 2.5 amps. 32v CT @ .025 amps.	$32.50
2—FILTER CHOKES	$15.90
2—2 mfd. 2000v CONDENSERS...	3.50
2—Type 866 TUBES	1.78
2—PLATE CAPS	.40
2—SOCKETS	.40
1—PR. HASH FILTER CHOKES	.79
PER EACH—AS ABOVE COMPLETE	$49.50

TRANSFORMER—115 V. 60 Cy.
HI-VOLTAGE INSULATION

3710v @ 10 ma.; 2x2½v @ 3A	$ 9.95
2500v @ 15 ma.	6.50
2500v @ 4 ma.; 2½v 2A. 6.3v @ 1 amp.	7.95
2150v @ 15 ma.	5.50
1750v @ 4 ma.; 6.3v @ 3A	6.50
1600v @ 4 ma.; 700v CT @ 150 ma.; 6.3v @ 9A	7.95
525-0-525v @ 60 ma.; 925v @ 10 ma.; 2x5v @ 3A; 6.3v @3.6A; 6.3v @2A; 6.3v @ 1A	7.95
515-0-515v @ 175 ma.; 5v @ 3A; 2.5v @ 5A	5.95
500-0-500v @ 25 ma; 262-0-262v @ 55 ma.; 6.3v @ 1A; 2x5v @ 2A	4.49
500-0-500v @ 100 ma.; 5v CT @ 3A	4.95
450-0-450 @ 200 ma.; 315 @ 10 ma.; 6.3v @ 7A; 5v @ 3A; 5v @ 2A; 110/220v Pri.	10.95
450-0-425 @ 200 ma.; 150-0-150 @ 100 ma.; 40v @ 1A; 6.3v @ 5A; 5v @ 3A; 110/ Dual Pri. tapped	7.50
400-315-0-100-315v @ 200 ma.; 2.5v @ 2A; 5v @ 3A; 6.3v @ 9A; 6.3v @ 9A	6.50
400-0-400v @ 200 ma.; 5v @ 3A	4.95
350-0-350v @ 150 ma.; 5v @ 3A; 6.3v @ 6A; 78v @ 1A	4.95
385-0-385-550v @ 200 ma.; 2½v @ 2A; 5v @ 3A; 3x6.3v @ 6A—PRI. 110/220	7.95
350-0-350v @ 150 ma.; 5v @ 3A; 6.3v @ 7.5A; 6.3v @ 3A	4.99
350-0-350v @ 35 ma.	1.45
340-0-340v @ 300 ma.; 1540v @ 5 ma.	5.95
335-0-335v @ 60 ma.; 5v @ 3A; 6.3v @ 2A; 0-13-17-21-23v @ 70 ma.—PRI. 110/220	4.95
325-0-325v @ 120 ma.; 10v @ 5A; 5v @ 7A	3.49
300-0-300v @ 65 ma.; 2x5v @ 2A; 6.3v @ 2½A; 6.3v @ 1A	3.49
250-0-250v @ 100 ma.; 2x6.3v @ 4A; 6.3v @ 5A; 6.3v @ 1A	4.95
150-0-150 @ 80 ma.; 150 @ 40 ma.; 6.3v @ 3.5A; 6.3v @ 1A	1.98
150v @ 55A; 150v @ 2.13A; 5v @ 5A	5.95
120-0-120v @ 50 ma.	.98
80-0-80v @ 225 ma.; 5v @ 2A; 5v @ 4A	3.95
24v @ 6A	3.50
3x18v @ 2A	3.95
13.5v CT @ 3.25A	2.95
3x10.3v @ 7A; CT	9.95
12.6v CT @ 10A; 11v CT @ 6.5A	7.95
3x6.3v @ 1A; 2x6.3v @ 2A; 10v CT @ 10A; 12.6v CT @ 1A	4.95
6.3v @ 12A; 6.3v @ 2A; 115v @ 1A	3.95
6.3v @ 10A; 6.3v @ 1A	3.50
6.3v @ 1A; 2½v @ 2A	3.45
5v @ 20A; Dual 110v PRI	3.49
6.3v @ 21½A; 6.3v @ 2A; 2½v @ 2A	5.95
5v—190A $17.50 6.3v @ 1A	.98
5v—115A 14.95 8v CT 1A	.98
2.5v @ 20A 3.49 .6v @ 15ARMS	2.98
6.3v CT @ 3A; 5v CT @ 4A	4.25

All Prices Subject To Change Without Notice

All merchandise guaranteed. Mail orders promptly filled. All prices F.O.B. New York City. Send money order or check. Shipping charges sent C.O.D. Minimum order $5.00. 20% Deposit required with all orders.

RADIO HAM SHACK Inc.
63 DEY STREET • NEW YORK 7, N. Y.

the back of the changer base. Other makes of pickups will probably require slightly different mounting and operating procedures. When selecting the pickup location, be sure that it does not interfere with dropping of records by the changer mechanism when the machine is used in that manner.

The conversion is now complete. A single-pole, double-throw switch may be installed, if desired, to switch either pickup to the amplifier input. To change the mechanism from 78 to 33⅓ r.p.m., remove the turntable, loosen the setscrew in the motor pulley, and remove it from the shaft. Then replace the turntable. Play the Microgroove records with the changer selector switch in "Manual" position.

—30—

Sell Your Service

(*Continued from page* 49)

tering the shop has much to do with his acceptance or rejection of your service in the future. For this reason, the time spent on designing or arranging shop fixtures and displays should not be considered as lost. Displays, radio sets, and accessories should be arranged so that they present an effective sales argument the moment the customer walks in the shop. This form of silent selling, which depends mainly on "eye appeal" as the means of telling its story, should never be neglected. This especially applies to window displays, which play a vital part in attracting new customers and drawing them into the shop.

In arranging window displays, put yourself in the place of a passerby. There are a dozen stores on your street—if you had no personal or special interest in any of them, what would cause you to stop? What type of window decoration or display would attract your attention or appeal to your curiosity?

Keep all displays simple and to the point; avoid overdressing or filling the windows too full of merchandise. Over-crowding creates confusion and often detracts instead of attracting. It is a good idea to change the window occasionally, decorating and using appropriate motifs on holidays, seasons, and other special occasions.

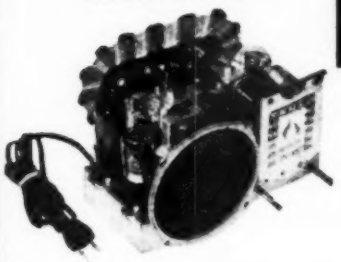
Fluorescent lighting, especially in the shop and on the sales floor, helps give the shop a clean, light appearance, and relieves eye-strain not only for your customers, but for you and your servicemen. At the same time, the reduction in electric bills will pay for the fluorescent fixtures within a comparatively short time.

Personal appearance may be improved by wearing an inexpensive service tunic or uniform whenever at the service bench. These items give a more professional appearance to the shop and may be obtained quite reasonably from at least one service organization.

IRVING JOSEPH

WHERE **PRICE** IS AN OBJECT AND QUALITY IS UNDERSTOOD - EVERY ITEM WE SHIP IS BACKED UP BY AN UNCONDITIONAL GUARANTEE.

CORONET 5 Tube Superheterodyne Receiver Kit



- **Complete with plastic cabinet and carrying handle.**
- **117V, AC-DC operated. Power supply rated at 30W.**
- **Tube Lineup—12SA7, 12SK7, 12SQ7, 35Z5, 50L6.**
- **Tuning range—540-1700 KC. Designed for fullest selectivity along entire band.**
- **Built-in loop antenna.**
- **All parts engineered to fit; no additional cutting or drilling to do.**
- **Nothing else to buy except solder. Kit packed complete including tubes.**

This kit combines an excellent educational program with many hours of building and listening pleasure; particular stress being placed upon ease of construction. Easy step by step instructions are furnished, along with pictorial diagrams and voltage and resistance charts for efficient maintenance and further experimentation. Many circuit features employed by big name manufacturers are employed to make this set, when completed, comparable to any 5 Tube AC-DC Radio now on the market.

LIST PRICE $11.95

Dealers, educational institutions, write for quantity discounts.

FILTER CONDENSERS

Supplies limited. There's no more where these came from. Each condenser fully guaranteed.

50 Mfd, 25V. Mfg. by C-D. ⅜" Dia. x 1½"..... **10 for $1.45**

4 Mfd, 450V. Mfg. by C-D. ⅜" Dia. x 1½"..... **10 for $2.10**

8-8, 450V—8, 350V—50, 50V. Mfg. by C-D. 1¼" Dia. x 3½" with mounting strap. **59c** each..... **10 for $5.20**

NOVEMBER CONDENSER SPECIAL

40-20, 150V. Wax impreg. paper filter. Mfg. by Industrial. 1" Dia. x 3". Guaranteed perfect.

29c each. **10** for **$2.60**. **100** for **$23.50**

WAFER SWITCH

4 Gang, 1 Pole each gang, 12 position. Wafers easily removed for many additional switching requirements. Measures 3¼" overall length x 1⅞" overall diameter. ¼" Dia. Shaft ½".

75c each. **10** for **$5.80**

WAFER SWITCH

Single wafer. 3 Pole 2 Pos. Very versatile. Can be used as SPST, SPDT, DPST, DPDT, 3P2T. 1¾" overall length x 1⅞" overall dia. ¼" Dia. Shaft x ½".

10 for **$2.10**

Special Purchases!!

SOCKETS

7 Prong Miniature. Wafer type. ⅜" mtg. center.
10 for **65c**..... **100** for **$5.25**

7 Prong Miniature. Molded bakelite. With locking ring. **10** for **80c**..... **100** for **$6.75**

4 Prong. Black molded Bakelite. With locking ring.
10 for **60c**..... **100** for **$5.25**

5 Prong. Saddle Mount. 1½" mtg. center. Brown bakelite. **10** for **60c**..... **100** for **$5.25**

6 Prong Black Molded Bakelite with locking ring.
10 for **60c**..... **100** for **$5.25**

8 Prong Loctal. Saddle mount. 1 5/16" mtg. center.
10 for **60c**..... **100** for **$5.25**

Octal Socket. Amphenol. 1 5/16" mounting center.
10 for **60c** **100** for **$4.00** **1000** for **$32.50**

PAPER CONDENSER ASSORTMENT

100 assorted paper tubular and molded paper by-pass condensers. Wide assortment of standard capacities at 150V, 200V, 400V and 600V. Every condenser guaranteed. Kit of 100..... **$3.85**

RESISTOR ASSORTMENT

100 insulated carbon and wire wound resistors. Standard color coded. Wide assortment of useful sizes, ⅓, ½, 1, 2, 5, 10, and 20 W.
100 Assorted..... **$1.95**

COAXIAL CABLE

RG8/U—52 Ohm. Amphenol.
$2.85 per 100' **$25.00** per 1000'.

RELAYS

110V AC SPST..... **$1.00**
110V AC DPDT..... **1.50**

SLIDE SWITCH

Choice of SPDT or DPDT..... **8** for **$1.00**

GENERAL PURPOSE HOOK-UP WIRE

	Per C	Per M
*No. 12 Stranded	$1.15	$9.00
*No. 16 Stranded	.95	7.50
*No. 18 Choice of Solid or Stranded	.75	6.50
*No. 20 Choice of Solid or Stranded	.65	5.50
†No. 22 Choice of Solid or Stranded	.55	3.75
†No. 24 Solid	.45	3.50

*Available with spun-glass or cotton insulation.
†Available with spun-glass or plastic insulation.
Please state first and second choice of colors or colored tracer.

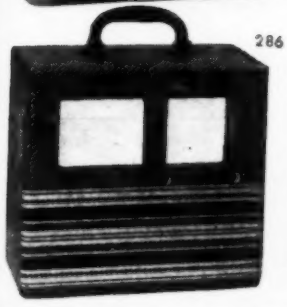
RADIO CABINETS

BELOW MANUFACTURERS COST

261

No. 261. Leatherette covered. 12x11½x7½". Cutout as shown. Plastic handle. With grill and dial glass **$1.95**

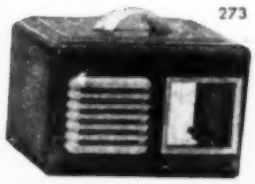
286



No. 286. Leatherette covered. 9½x12½x5". Leather handle. White—brown trim. Cutout as shown. **$1.50**

No. 285. Same as above. Brown and Tan..... **$1.50**

273



No. 273. Plastic. Choice of black or ivory with contrasting trim as shown. Cutout as shown. 10½x6x6¾" overall dimensions. **$1.50**

Jobbers, manufacturers, quantity buyers of any standard receiver components, inquiries invited. Prompt quotations upon request.

TERMS: *All items subject to prior sale. Prices subject to change without notice. A 25% deposit required on all C.O.D. orders. All shipments made F.O.B. Chicago, Illinois.*

IRVING JOSEPH

215 S. Halsted St.,
Chicago 6, Ill.

The effect of a neat, modern, professional-looking service bench on customer-confidence cannot be over-emphasized. A neat, logical arrangement of test equipment also aids considerably in increasing servicing efficiency and ease of operation.

Dependability is an acquired art. If a set is promised at a specific time, be sure it is ready. If unforeseen difficulties arise and the job cannot be completed on schedule, lend the customer an "extra" set until his is ready. Many times this will result in an extra sale, in addition to creating added good-will.

The customer will also remember those "little things" such as plugging the set in for a minute or two to recheck (and to allow him to listen to its improved operation), wiping fingerprints (imaginary or otherwise) from the cabinet, tightening the dial and drive cable, straightening the pointer, etc. He will be duly impressed by the fact that you took a "personal" interest in his set, whether he shows it or not. If he asks what was wrong with the set, answer his questions as simply and as straightforwardly as possible. In most cases he is idly curious—he won't understand your explanations but he appreciates them anyway. If your answers sound evasive or too technical, the customer immediately gets the impression that you're trying to "cover up" unnecessary repairs or charges. The use of itemized repair bills or invoices helps in establishing customer confidence. Don't forget stickers, calling cards, service guarantees, etc. as extra aids in promoting a feeling of position, efficiency, and business ethics.

While conversing with the new customer, study his face or features and associate them with his name. Remembering names and faces is another habit which can be acquired and developed. It is surprising how much it *can* be developed in a comparatively short time. If the customer makes personal mention of himself, his family, car, etc., jot these down on his repair card (after he leaves). On his next visit it is an easy matter to "look in the files" and casually ask questions about his car, that new baby, etc. Such trivial things are important to him, and they go a long way toward molding new friendships and increasing business contacts.

On outside calls, be sure to leave your business card. Ask the housewife to refer you to her friends whenever they need a serviceman. In many cases she knows of at least several friends who need some immediate radio service, or who perhaps are in the market for a new set. Don't forget to ask about other sets in the house when you make a delivery—these often add considerably to shop income. If you do appliance servicing, mention this fact—every home has one or more appliances which are not in order.

Keep your advertising up-to-date. Here are a few of the ways advertising can be effectively employed: (1)

run ads regularly in your local newspapers, (2) run short spots on the local station (if possible), (3) send postcard ads regularly to established and new customers, (4) supply book matches, blotters, pencils, key chains, etc. to cafes, business houses, and other establishments, (5) use the telephone to solicit new and repeat business, (6) employ a mailing list and keep it up-to-date, (7) follow social events in the papers and offer to rent sets, phonographs, or sound equipment for dances, weddings, and special occasions, (8) send envelope stuffers and special announcements with your statements, (9) put up eye-catching signs at strategic spots along the highways where allowed, and (10) adopt a short, "catchy" service motto; use it on your bills, stationery, business cards, service truck, telephone ads, etc.

Extra advertising for your shop can be accumulated by visiting and speaking before the local Rotary Club, Lions Club, Chamber of Commerce meetings, etc. Join civic associations and projects and take an active part in their affairs. At first, the points just mentioned may appear to take up too much of your time. By careful planning and arranging, however, you will be able to accomplish a good deal more than you think. A serviceman who keeps up with the affairs and accomplishments of the community is in a better position to share in its dividends. Concentrate on really *selling* your service, and your list of satisfied customers will take care of itself.

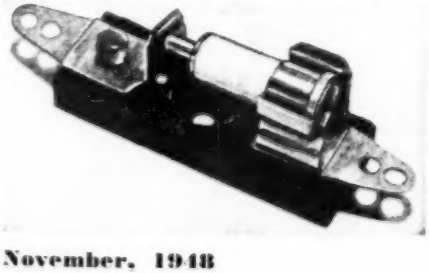
—30—

CRYSTAL DIODE CLIP

THE 1N21B crystal diode is similar electrically to the versatile 1N34, and its very low price in the surplus market makes it especially interesting to the ham or experimeter. Its big drawback has been in mounting, however, since it is not equipped with pigtails like the 1N34.

The mounting shown in the photograph is simple and sound, both mechanically and electrically. It may be made in a very few minutes from an inexpensive fuse holder. The clip on one end of the holder is turned ninety degrees, and half of it is broken off by bending back and forth with long-nosed pliers. A blow with a center-punch forms a depression into which the small end of the crystal unit seats. The modified clip is then bent toward the other end of the holder until it holds a slight tension on the seated crystal, as shown in the photograph. The crystal diode can be removed and replaced in the clip as easily as a fuse . . . . . C. W.

Method for mounting a 1N21B crystal diode.



What? Where? and Why?

Three questions that provide the easy answer to many of the time-consuming problems faced by servicemen.

By NICHOLAS B. COOK

MOST successful radio technicians have a formula which, when applied to the servicing of radios and allied equipment, enables them to come up with the right answer in the shortest possible time.

One of the most direct approaches to the problem of servicing can be summarized in three words: *What? Where? Why?* Since the author uses this method, I may be pardoned for describing it in the personal terms of first-hand knowledge.

What?

What is the trouble? Dead? Noisy? Weak? Cuts out? Sounds bad? The customer gives me this information and more if I ask questions carefully. The complaint is written down immediately on the repair tag.

Sometimes a receiver is left at the shop during my absence. My first approach then is still to find out *what* is wrong. I do this, not by looking underneath the chassis or testing the tubes but by *trying out* the radio. By far the best way is to use the "Versatile Test Gadget" described in RADIO NEWS, November, 1944. This is simply a series lamp of 100 watts or so but it gives a lot of information, and safely.

Where?

Where is the trouble? Speaker? Audio section? The r.f.-i.f. section? Power supply?

Looking at the underside of the chassis can waste a lot of time. If the receiver is *dead*, a competent man can tell *where* without turning the chassis upside down. Often he can do this without instruments. *Given the opportunity* I usually do it not in ten minutes but in ten seconds.

Noise can be located almost as quickly, by pulling tubes or grounding grids.

Weak reception is certainly not the fault of the audio section if a finger on audio grid causes a vigorous hum.

Cut-outs are somtimes easy to find, sometimes very difficult. Good clues can be obtained from the aural character of the interruption. A loud snarp click usually involves "B" voltage, a quiet stopping may be a coupling condenser, a slow fade is probably of thermal origin.

There are fancy signal tracers that can put a detective in each section of the receiver. They eventually tell you *where* while you have been busy with more profitable work. In my opinion the best instrument is a simple, sensitive, untuned tracer that can follow the signal without touching any terminals. When the signal stops, you find out *where*. As far as this job is concerned, the soldering iron is still cold but time's a-wastin'.

Hum can be localized as easily as any other noise.

Distortion may require another gesture toward instrumentation, but tube substitution is a simple and rapid preliminary.

Why?

Here is where the high-class man really demonstrates his superiority. Here he employs the cumulative power of knowledge, experience, skill, and native talent.

He knows *what* the trouble is, he knows *where* it is, by purely elementary observation, requiring at most a few minutes (intermittents excluded). Now he focuses his analytical powers not on the whole chassis but on one functional section.

Audio trouble is usually easy to find, *if you are looking in the audio section*. More than once I have acted as consultant on "weak reception" only to discover *immediately* that the speaker cone was jammed.

Distortion ordinarily is confined to detector and audio sections. Analysis in audio is a simple matter of using ears, meters, and possibly an oscilloscope.

Hum can be immediately analyzed in character and frequency by the use of the scope. When the hum is identified, it is ready for the kill. On one job I encountered a hum that I could not nail down as 60 or 120 cycles. It was a random frequency in between. Given this clue, I had no trouble finding self-oscillation in a voltage regulator tube.

Intermittents are not duck soup for anybody. Touching, tapping, pounding, pulling, twisting, turning, are all involved in the mechanical techniques of locating cut-outs. Plastic pliers and polystyrene probes are excellent helps. When all these fail, we become hunters, possessed of great cunning and infinite patience, for the patience of the hunter is a greater patience than that of the hunted.

Oscillators may be the cause of baffling troubles, but to the man who knows his fundamentals the oscillator is just another circuit.

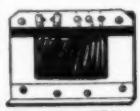
The high-class man knows all the basic circuits. He fully appreciates the value of circuit diagrams and

NOW READY!

SEND FOR YOUR **FREE** COPY TODAY!

CARBON HANDMIKE
Type T-17B handmike. S. B. carbon with push-to-talk switch on handle. Brand new. Shpg. Wt. 3 lbs.
Limit of one to a customer
ONLY **$1.25**

MODULATION TRANSFORMERS
RCA 1 KW Modulation Transformer. Primary will match tubes up to 10,000 ohms plate to plate. Secondary No. 1, 450 MA. Secondary No. 2, 80 MA for beam, tube screen grids.
ONLY..... **$14.95**



Shpg. Wt. 55 lbs

SPECIAL! Save as much as 50% on some of our many smash values in used, Reconditioned, "Good-As-New" Test Instruments and Communication Equipment. Write for complete list of these amazing bargains.

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Getting far more for your used Test and Communication equipment means paying much less for the new! Cash in now on the bigger-than-ever allowances offered by Walter Ashe on your used equipment. Wire, write, phone or use the handy coupon below.

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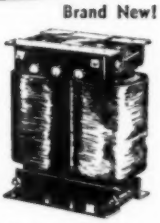
SURPLUS RG 8/U COAX CABLE
Brand New, Nationally known maker.
06c per ft.
$5.00 per 100
$45.00 per 1000

HAMS LOOK!

Not Surplus! Brand New!
Real GALLON Transformers



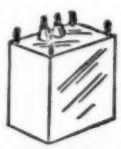
TYPE E-5707
3000 Volts D. C. out of filter at 650 MA. (ICAS). Pri: 115/230 VAC 60 Cy.
Shpg. Wt. 47 lbs.
ONLY **$48.00**

TYPE E-5706
2500 Volts D. C. out of filter at 500 MA. (ICAS). Pri: 115/230 VAC 60 Cy.
Shpg. Wt. 33 lbs. ONLY **$33.00**

TYPE E-5105
2000-1750-1500 Volts D.C. out of filter @ 500 MA. (ICAS) Pri: 115/230 VAC 60 Cy.
Shpg. Wt. 30 lbs.
ONLY **$36.00**

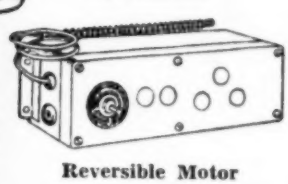
FILTER CHOKES
4 Hy. x 300 Ma., 40 ohms Res #6317. Shpg. Wt. 13 lbs.
ONLY.... **$4.95**

8 Hy. x 500 Ma., 55 ohms Res #8056. Shpg. Wt. 18 lbs.
ONLY.. **$11.85**



No. 8783—2-6 Hy. x 500 MA Swinging Choke. Shpg. Wt. 28 lbs.
ONLY.. **$11.85**

BOMBSHELL SPECIAL!



Reversible Motor
Originally used for heat control on Douglas Bombers. Ideally suited for rotation of lightweight Amateur, FM or TV beams. Geared down to ½ to 2 RPM with max. torque rating of 50 inch pounds. Size 2¾"x3¾"x9". Simple instructions included. Shpg. Wt. 6 lbs.
LIMIT OF ONE TO A CUSTOMER. ONLY **$7.45**

FILTER CONDENSERS
3 MFD. x 330 VAC. Good 1000 VDC 74c
2 MFD. x 440 VAC. Good 1500 VDC 74c
3 MFD. x 400 VAC. Good 1250 VDC . . . 98c
6 MFD. x 440 VAC. Good 1500 VDC . . $1.25
8 MFD. x 440 VAC. Good 1500 VAC . . $1.47
2 MFD. x 660 VAC. Good 2000 VAC . . $1.47
2 MFD. x 2500 VDC. Oil filled. Well known mfg. Single Lots $3.43 each. Two or more $3.25 each.
Shpg. Wt. 3 lbs., all types.

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Gentlemen:
☐ Rush bigger-than-ever "surprise" trade-in allowance on my _____ for
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_____
(show make, model of new equipment desired)
☐ Send bargain list of reconditioned, good-as-new (check one or both)
☐ Test Instruments, ☐ Communication Equipment.
☐ Rush my FREE copy of new 1949 Catalog.

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service notes. In looking at a diagram he can instantly divide it into functional sections.

If a circuit does not work he knows what tests to make. For he has learned by experience that the laws of nature are invariable. If conditions are right the circuit *must work*. If it does not, there is a hidden imperfection still to be ferreted out by reason, perspicacity, and common sense.

After the main trouble has been cleared, *then* is the time to look things over, to make a routine test of tubes, to clean condenser plates and other parts, to realign, etc. Other troubles may appear in the course of the tryout performance. It is often wise to anticipate troubles by replacing doubtful parts,

But the best rule is, *first things first! What* is the trouble? *Where* is it? *Why?* —30—

IMPROVE TV RECEPTION

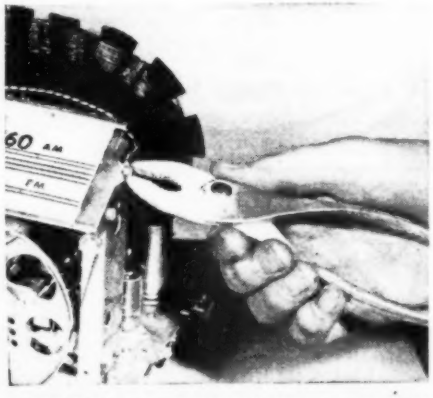
WHEN using 300 ohm line as the feeder for a television antenna system, the length of the feeder is quite critical. To get the best signal input to the receiver the feeder should connect to the antenna coil at a voltage node. A very simple way to accomplish this is to use a piece of tinfoil about 3 inches square. Wrap the foil around the feeder so as to form a shorted loop. Now slide this band away from the antenna post of the television set until the picture strength is at a minimum. Then move the band back towards the set again and one point will be found where the picture becomes brightest.

The tinfoil can be left in this position permanently and, if wrapped with Scotch tape, it won't slide around. When adjusting the feeder length in this manner we automatically compensate for the piece of feeder line connecting the antenna binding posts and the antenna coil. If this adjustment is made on the weakest station you should notice considerable improvement in the picture, while the other channels will not be noticeably affected. . . . . M.K.

WHEN POINTER STICKS

WHEN the sliding pointer sticks or works hard on the middle section of the dial look for a "bulged" or raised portion of the dial. This may be checked by pressing downward on the dial with the finger.

Slight loosening of the bolts holding the dial assembly may cure this trouble. . . . . H.L.



International Short-Wave
(*Continued from page 65*)

By the end of that month, SEAC had closed down and so did the BMA, and Singapore returned to civil government.

"The Voice of Britain" found itself a small island of British Foreign Office staff among vast numbers of Colonial Office officials which position has continued. From July 1946, the staff rapidly increased as new members began to arrive from Britain and from Australia. The scope of programs also increased. Time on the air on August 1 was 7¼ hours. A new studio had been added to the two already in operation. The period of August-December 1946 was one of hard, but often amateurish, work on the part of the program staff. From January 1947, organization began to take a more permanent shape and many improvements were initiated. All the time more and more ambitious programs were attempted as technical equipment was improved and added to by station engineers. A big future seemed assured for the station. But in the autumn of 1947 an economic crisis shook Great Britain and, of course, had its effect even in Singapore.

Early in January 1948, the Controller of Broadcasting called a staff meeting and announced far-reaching changes. Many staff members were dismissed as superfluous and programs and hours on the air were drastically cut. It was announced that the British Broadcasting Corporation, London, would be taking over *BFEBS* from the Foreign Office, and that relays of BBC programs would increase. First relays were taken from BBC in July 1946, and what a thrill it was to link them up exactly with *BFEBS'* own announcements! Yet those relays were few in number compared to those that have been carried during 1948. Miss Ballingall comments that *BFEBS* engineers are artists in clever "go-over" work on the AR-88 triple-diversity receivers they use for picking up BBC for relay.

On July 1, 1946, the station started operation on 15.275 and at the beginning of August of that year transm ssion on 15.30 began. From April 20, 1947, to January 17, 1948, transmitters were "loaned" to *Radio Malaya* for its lunch-time program at 0530-0630 GMT. This had to stop, however, when *BFEBS'* force was cut down, since there were not now enough engineers to operate the transmitters. On August 17, 1947, a frequency of 9.69 replaced 15.275. Since the BBC also uses this frequency, *BFEBS* limited its use of 9.69 to 1030-1700 GMT from October 3, 1947. The gap from 0800-1030 GMT was filled in by yet another new frequency—21.72—but that was surrendered last March, and its place was taken by 15.30, beamed to 35 degrees. The main 15.30 frequency is beamed

to 340 degrees. The 11.735 frequency was replaced by 11.77 on December 28, but only lasted to February 8 of this year, when 11.730 was substituted.

The station has requested use of 11.850 to replace 11.730, but at last report permission had not yet been received. Since the 21.72 channel is essentially a long-distance antenna service, it will not likely be put into operation again until higher-powered transmitters are ready. It is expected the BBC, which officially took over *BFEBS* on August 8 of this year, will construct new transmitters (probably of 100 kw. power) in Singapore, but these will probably not go into operation for at least a year or so yet.

Just what changes in policy will be effected by BBC are not yet known. Since BBC does *not* verify reception reports, it is likely that in future *BFEBS* may adopt a similar course. I have had recent word from the station, however, that it was still verifying the same as it did before BBC took over.

Programs at present are taken from BBC's General Overseas, Far Eastern, and Eastern Services. Schedule is 0415-1130* on 6.77; 0600-1130 on 9.69; 0415-1130 on 11.73, and 0415-1130 on 15.30. News periods are scheduled 0415 (headlines); 0600; 0645; 0800; 0810 (home news); 0915; 0945 (Radio Newsreel relayed from London, *Saturdays only*); 1000 (Radio Newsreel, *except Saturdays*), and 1100, followed by news analysis. Transmitters are listed at 7½ kw.

Address of BFEBS is Thomson Road Studios, P. O. Box No. 434, Singapore, Malaya.

Finally, here is a brief word about Singapore which is an island 27 miles long by 14 miles wide with an area of 225 square miles. Singapore is the capital of the Straits Settlements, a Crown Colony in British Malaya. Singapore just misses being the southernmost point of Asia by a half-mile water channel. The Johore Causeway joins it with the mainland of British Malaya and affords through train service between Bangkok, Siam, and Singapore. It is at the funnel point of the Strait of Malacca, which extends between the Malay Peninsula and the island of Sumatra, the great water highway between India and China. Area of the Straits Settlement is 1356 square miles, and the 1941 population was estimated at 1,435,895.

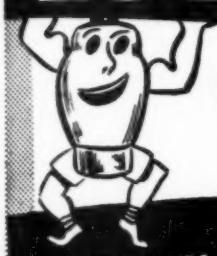
Singapore was occupied by Japanese forces in February of 1942 in the conquest of Malaya. It was restored to the British in 1945 with the surrender of Japan. Singapore has a polyglot population of more than 600,000, of which 80 per-cent is Chinese. The port was served by 30 steamship lines and annually was host to 30,000 ships. The city had magnificent banks, modern office buildings, and stately Government palaces.

Incidentally, British Malaya has long provided much of the world's tin and rubber. The Malay States are the greatest source of tin in the world. The British introduced rubber trees

(*Note: Unless otherwise indicated, all time herein is expressed in American *EST; add* 5 hours for *GCT*. "News" refers to newscasts in the *English* language.—K.R.B.)

One of the features of a new drive-in restaurant in San Francisco is a unique "wireless jukebox." A patron can drive into the court, tune in his car radio to 750 kc., give a nickel to the car-hop and have the song of his choice come over his car radio. The restaurant's miniature transmitting unit will not radiate more than 80 feet and because it plays music only within this limited range does not need to be licensed by the FCC. Loudspeakers broadcast the music inside the restaurant, in exactly the same manner as any conventional jukebox.

LOW OVERHEAD-



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Type	Each	Lots of 10 Each
0Z4	69c	59c
1A3	45	39
1A5GT/G	59	49
1A7GT	55	49
1C6	75	68
1E7	99	89
1H4	59	52
1H5GT/G	59	49
1H6	74	69
1J6	80	72
1L4	49	45
1LH4	69	59
1LN5	69	59
1N5GT/G	59	49
1R5	55	49
1S5	59	55
1T4	69	55
1U5	36	30
1V	45	39
2A5	54	43
2A6	45	35
2A7	49	39
2X2/879	35	29
3A4	49	39
3Q5	55	49
3S4	55	45
3V4	79	69
5U4G	50	40
5W4GT	39	34
5X4G	39	35
5Y3G	42	37
5Y3GT/G	40	33
5Y4G	39	32
5Z3	49	39
5Z4	59	49
6A6	69	61
6A7	50	45
6A8GT	49	39
6AB7/1853	53	46
6AC5	69	59
6AC7/1852	65	60
6AG5	79	69
6AH6	49	39
6AK5	74	69
6AL5	49	38
6AQ6	59	55
6AQ7	69	59
6AU6	49	39
6AV6	49	39
6BE6	49	38
6BG6G	99	89
6BJ6	59	49
6C4	29	25
6C5GT	40	35
6C6	45	32
6D6	49	45
6F5	55	45
6F6GT	45	39
6F7/VT70	49	39
6H6GT/G	45	39
6J5GT/G	45	39
6J8	73	65
6J7GT	42	38
6K6GT/G	45	39
6K7G	50	41
6K7GT/G	49	39
6L5G	69	59
6L7	84	78
6N4	49	38
6Q7GT	47	39
6R7GT	59	49
6SA7GT/G	44	37
6SB7	55	45
6SF5	49	39
6SH7GT	40	32
6SJ7GT	44	37
6SK7GT/G	49	39
6SL7GT	49	47
6SN7GT	49	47
6SQ7GT/G	44	37
6SS7	59	49

ALL BRAND NEW

6U6	49	39
6U7G	35	25
6V5G	59	49
6V6GT/G	45	39
6X5GT/G	49	39
7A4	53	43
7A7	59	49
7B6	44	35
7C5	49	44
7F7	49	44
7J7	54	49
7N7	49	44
7X7 XXFM	44	35
7Y4	44	35

INDIVIDUALLY CARTONED

12A6	29	25
12A8GT	35	29
12AT6	50	45
12AT7	69	59
12BA6	50	45
12BE6	50	45
12F5GT	35	27
12H6	39	34
12J5GT	25	19
12J7GT	45	39
12K7GT	45	39
12K8Y	35	25
12Q7GT	45	39
12SA7GT/G	40	32
12SF7	35	32
12SC7/1634	49	39
12SG7	43	37
12SJ7GT	55	49
12SK7GT/G	45	35
12SL7	49	43
12SN7	49	43
12SQ7GT/G	40	32
12SR7	35	32
14A7	65	55
14B6	59	49

IMMEDIATE DELIVERY

24A	49	39
25L6GT/G	49	39
25Z5	49	45
25Z6GT/G	45	39
26	45	32
27	49	44
30	59	49
32	80	75
32L7GT	52	48
34	69	59
35/51	42	32
35L6GT/G	45	39
35W4	43	40
35Y4	43	40
35Z3	44	35
35Z5GT/G	43	39
36	35	29
37	45	39
38	45	39
39/44	25	19
41	49	45
42	47	41
47	49	40
50L6GT	50	45
50Y6GT	50	45
56	55	45
57	45	39
58	45	39
59	65	59
71A	39	29
75	50	39
76	49	45
77	35	27
78	49	39
80	49	38
83V	79	69
84/6Z4	49	39
85	49	45
89	49	46
99V	35	25
99X	35	25
117Z6GT/G	89	76
182B	99	89
1231	39	29
1644	29	19

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3" P.M.—1.47 oz Alnico V	1.15
4" P.M.—1 oz Alnico V	.99
4"x6" P.M.—Speaker	1.89
5" P.M.—1 oz. Alnico V	.99
6" P.M.—1.47 oz Alnico V	1.15
8" P.M.—2.15 oz. Alnico V	1.55
8" P.M.—2.15 oz. Alnico V	2.75
10" P.M.—6.8 oz Alnico V	3.69
12" P.M.—6.8 oz Alnico V	4.39
12" P.M.—3.2 oz. Alnico V	4.95
12" P.M.—6.8 oz Alnico V	5.95

12" P.M.—21 oz Alnico with 6V6 P.P. Output $7.95
8" Dynamic 680 ohms field with 6V6 P.P. Output 3.95
12" Dynamic 680 ohms field with 6V6 P.P. Output 6.95
12" Dynamic 1000 ohms field 5.95

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6 Mfd.	600 VDC	69c
7 Mfd.	600 VDC	74c
8 Mfd.	600 VDC	79c
10 Mfd.	600 VDC	89c
8 Mfd.	1000 VDC	$1.90

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500,000 ohms V.C., 3" shaft
1 meg ohms V.C., 3" shaft
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N7 Webster Crystal Cartridge	1.49
Astatic N-y-on Cartridge	2.95

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SPST—3 amps	23c
SPDT—3 amps	25c
SPST—6 amps	29c

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100 mil—6.3V @ 3 amps— 5V @ 2 amps 750V C.T.	2.95
150 mil—6.3V @ 4 amps— 5V @ 3 amps 750V C.T...	3.39
200 mil—6.3V @ 3.3 amps— 5V @ 3 amps 815V C.T.	4.45

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about fifty years ago from seed smuggled out of Brazil, and rubber trees now practically cover the Malay States.

As we take our leave of the *British Far Eastern Broadcasting Service*, Singapore, which is no doubt destined to become one of the strongest voices in the Far East, we wish the station and its personnel the best of fortune in the years ahead!

* * *

New Zealand on Air

By the time you read this, the long-awaited Overseas Service of *"Radio New Zealand,"* Wellington, short-wave division of the New Zealand Broadcasting Service, should be on the air with regular daily transmissions. The New Zealand DX Club, Inc., has sent me the following information on this Service:

"Radio New Zealand" will start regular overseas transmissions on September 27. Mr. Jones, the Minister of Broadcasting, has announced that the Dominion will reciprocate the services given to its listeners by most countries of the world. The service will provide a link with home for New Zealanders living abroad.

"Radio New Zealand" will be on the air *daily* from 7 to 9 p.m. New Zealand Time (0700-0900 GMT or 0200-0400 EST). Three quarters of the program will be devoted to musical items and a quarter to spoken matter, including a short bulletin of New Zealand news. Programs will carry recitals by New Zealand artists. There will be a weekly session of information designed to reach those who might be contemplating a tourist visit to the Dominion.

The new station will reach New Zealand dependencies and trust territory in the Pacific, and also Australia. Tests indicate that it will also be received in fair strength in New Guinea, the Netherlands East Indies, Malaya, India, and to a lesser degree in the Middle and Far East. Since the two transmitters are of relatively low power by international short-wave standards, being but 7.5 kw., officials say that reception in other parts of the world may be uncertain. However, when these stations tested some time ago, I received widespread reports of good reception from them. They sent a satisfactory signal to my listening post here in West Virginia.

Transmissions will be in the 31-, 25-, and 19-meter bands. I presume frequencies which were tested will be employed; they were ZL2, 9.54; ZL3, 11.78, and ZL4, 15.28.

I was informed by the station some time ago that they will verify; it would be well to enclose an IRC with report. Simply address New Zealand Broadcasting Service, Short-Wave Division, Wellington, New Zealand.

* * *

"Get Up"

Radio Cabimas, YV1RG, 6.150, Cabimas, Venezuela, has a novel "wake-you-up" program, reports D. W. McPheeters, department of Romance

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languages, Louisiana State University, Prof. McPheeters says:

"Cabimas is a little oil town of about 1000 inhabitants, 11 kms. from Maracaibo, so everybody knows everybody else! The patter goes something like this—(sound effect)—Knock! Knock! Knock! Roberto Aguilar, son las seis y cuarto, despiertese! (Robert Aguilar, it's 6:15, get up!) This station is in dual with YV1RV on 4.750 and the announcement goes something like this—'Radio Cabimas en la zona petrolera occidental transmitiendo del lado del lago Maracaibo,' which means 'in the western petroleum zone transmitting from beside Lake Maracaibo.' I usually get it with a fairly good signal."

* * *

Listeners' Annual Available

I have just received a copy of The Shortwave Listeners' Annual, 1948 edition, which is now available postpaid direct from the publisher for 3s. 9d. Price in American money is 90 cents, and for one dollar membership in the International Short Wave League will be included. Norman Stevens, who edited the Annual, tells me that a sample copy of Short Wave News will be included gratis with orders, if requested. This is an excellent publication and I heartily recommend it to all DX-ers. Address is Amalgamated Short Wave Press, Ltd., 57, Maida Vale, Paddington, London W.9, England.

* * *

Club Notes

England—The International Short Wave Club, London, has been arranging several special DX sessions lately from various parts of the world. The one from Leopoldville, 9.767, Belgian Congo, on September 15 featured a recording made by Arthur E. Bear, secretary of the group. Another broadcast to be dedicated to ISWC will take place Sunday, November 7, from *Radio Saigon*, 11.78, French Indo-China, at which time calls will be made to as many members as possible. Time for this broadcast was not known when this was compiled but it is presumed it will be some time around 0500-0600 EST; details will be announced from *Radio Australia* and by radio clubs throughout the world, prior to November 7. Address of ISWC is 100, Adams Gardens Estate, London, S.E.16, England.

New Zealand—A *new* DX organization is the New Zealand Radio DX League with headquarters at 15, Plunket Street, Dunedin S2, New Zealand. Address of its house organ, "DX Bulletin," is P. O. Box 283, Invercargill. The League has a combined Board of Directors—5 from Dunedin and 5 from Invercargill. Short-wave editor is Arthur C. Cushen, well-known "Down Under" DX-er, whose QRA is 212 Earn Street, Invercargill. Details may be obtained from the North American agent of the League, Don Trelford, 198 Strathellen Blvd., Toronto, Ontario, Canada.

Sweden—A *new* radio club in Sweden

is Vart Hem's Radio Club, organized in connection with the Swedish weekly magazine "for all the family," Vart Hem (Our Home). Members of this club do not pay any fee but they do receive a membership card and "five formulas" for reception reports. Head of the club is Tell Hellbom who is being assisted in preparation of material by Arne Skoog, well-known Swedish DX-er. During the first week, 300 members were registered. Address of the club is Sveavagen 53, Stockholm, Sweden.

United States—New officers of the Tri-State SWLR Club are Dan Ainsworth, president; Jim Zaloudek, vice-president; Ann Carson, secretary; Walt Carson, treasurer; Charles McCormick, chaplain; Edw. Broome, editor and sergeant-at-arms. Mr. Broome's QRA is Route 1, Vincentown, New Jersey.

* * *

Verification Data

VLT5/7, Port Moresby, Papua (British New Guinea) verified for Major, W. Australia, from The Superintending Engineer, Postmaster-General's Department, Engineering Branch, G.P.O., Brisbane, Queensland, Australia.

Address for reports on United Nations broadcasts from Paris is Mr. Boothe, UN Services, Palais de Chaillot, Paris 16, France. The Paris stations have been relaying in Spanish, *English*, Portuguese, French, and possibly other languages. (McPheeters, La.)

New QRA of *Warsaw Radio* is Polskie Radio, Koszykowa 8, Warsaw, Poland. (Bengtsson, Sweden)

HLKA, 1 Chung Dong, Seoul, Korea, now verifies with card; mailing QRA is Commanding General, USAMGIK, A.P.O. No. 235-2, c/o Postmaster, San Francisco, California, USA. (Cushen, New Zealand)

* * *

This Month's Schedules

(*NOTE:* Since some stations will be reverting from Summer Time between the time this was compiled and when you read it, you may find some schedules are now *one hour later* than listed herein.—K.R.B.)

Algiers—Algiers has been reported testing at 1130-1215 on its old frequency of 11.835. (Radio Australia)

Anglo-Egyptian Sudan—Radio Omdurman's 31-m. channel has been roaming around again—heard by Bluman, North Africa, on such frequencies as 9.635, 9.740, 9.670. (Via Radio Australia)

Argentina—Radio Belgrano, 9.545, is heard in Louisiana to 2200 closedown; heard also mornings as early as 0500. (McPheeters)

Austria—Kary, Pa., reports XL2C, 16 890, Vienna, heard to New York with network report at 1100; at time heard used clear speech, signal was marred a bit by a c.w. station.

Rot-Weiss-Rot, 9.575, has early morning musical program 0030; at 0115 gives news in Czech (furnished by Americans). (Pearce, England)

Belgian Congo—Leopoldville, 9.767, is scheduled 1300-1900 and 1900-2300; *English* periods begin at 1430 and 2100.

A special series entitled "Amongst Friends," in answer to listeners' letters, is radiated during the two *English* transmissions (except Sundays), and usually follows the news period. A preview of the coming week's program is given each Sunday 1445 and 2115.

Brazil—Ferguson, North Carolina, received an airmail verification from the new Recife station; schedules listed PRL-6, 780 kc., 0600-2100; ZYK2, 15.145, 0600-1400; ZYK2, 6.085, 1600-2100; ZYK3, 9.565, 0600-0800, 1000-1400, 1400-2100, *all* transmissions begin *one hour later* Sundays. Transmitters are Marconi Type SWB-10, 15/20 kw. input, modulated high level Class "B" feeding Beverage-type antennas orientated 258 degrees QRT S 03 20 South 34 58 12 West. Address is Harry W. W. Walden, Chief Engineer, "Radio Jornal Do Comercio," Recife, Pernambuco, Brazil. This station has been heard well from Sweden to Australia.

McPheeters, La., reports PRL8, 11.720, Rio de Janeiro, 0415-0500, announcing sometimes as *Radio Maua*, occasionally as *Radio Nacional*.

British New Guinea—Stein, Calif., says both outlets of Port Moresby's *new* station are heard well on West Coast; VLT7, 9.520 signs off at 0300 and VLT5, 7.280, comes on the air at 0315. At times interval signal appears to be bagpipes.

In verifying for Major, W. Australia, gave power as 2 kw. in aerial.

Canada—On West Coast, VE9AI, 9.535 (listed 9.54), "*Voice of the Great Northwest*," Edmonton, Alberta, is heard surprisingly well for only 200 watts; best around 1730-1900. (Smith, Calif.)

Ceylon—Colombo's 4.900 channel has been heard lately in California, mornings, best around 0830. (Dilg)

Chile—CB-1180, 11.998, Santiago, relays the 1745-1800 Spanish period from *Radio Brazzaville*. CE1174, 11.742, Santiago, has news 2200-2215 (presumably in Spanish), and gives evening schedule at 2230 according to which closes down at 0000. (McPheeters, La.)

China—Latest Nanking channel is 15.105 which relays XGOA broadcasts 0300-0915, with news 0400 and 0800. (It may be that at least some days there is a break or that it does not sign on until 0700.) Widely reported with good signal. This is the *new* 20 kw. outlet, replacing XGRZ, 17.765, and call is believed to be XGSO although only call announced is usually XGOA. Reception reports are desired by the station to XGOA, The Central Broadcasting Station, 25 Sze Tang Hsiang, Nanking, China. Tests on XGSW, 21.450, at 1930-2200, had been concluded and 15.105 is now used by Nanking at that time for relaying XGOA; news at 2015 and 2130. (Balbi, California and Huse, Washington) *Radio Australia* reports that at 0400 XGOA announces 15.105, 5.985, and 9.730 all in parallel.

XGHT, 6.096, appears to have drifted down slightly, does not seem on top of Cebu's 6.100 outlet as formerly; improved signal. (Dilg, Calif.)

The daily newscast period from XNCR, approximately 7.500, a Communist-controlled outlet, is now at 0840. (Dilg, Calif.)

XMAG, 4.275, Nanking, is again audible on West Coast. (Dilg)

XORA, approximately 11.700, Shanghai, has not been reported to me lately; *does anyone have information on this one?* Some time ago *THE BROADCASTER*, W. Australia, reported it on 9.820; however, that is the frequency of another Chinese outlet, XGOE (Kweilin).

In verifying for Stien, Calif., Hong Kong sent schedules showing ZWB3, 9.52 (actually appears 9.525) at 2330-0100 and 0530-1000; carries *English* programs from medium-wave ZBW (845 kc.) at 2330-0015, 0530-0630, 0800-1000, and Chinese programs from medium-wave ZEK (640 kc.) at 0015-0100, 0630-0800; news scheduled 0000 (followed by local weather report and forecast), 0600 and 0300 (relayed from BBC, London), latter followed by weather report and forecast. QRA is Hong Kong Broadcasting Studio, Gloucester Bldg., 2nd Floor, Hong Kong. Stien sent along an IRC and received prompt verification of his report.

Colombia—McPheeters, La., reports a new Colombian group heard at 2100-2300 (*not* complete schedule); they are HJCK, 830 kc., HJKB, 6.000, and HJKF, 9.520. Anxious to receive reports to Emisoras Nuevo Mundo, Bogota, Colombia. Station is being operated on a temporary permit from the Ministerio de Correos y Telegrafos. The 9.52 outlet has been reported also by Balbi, Calif.

Stark, Texas, reports Radiodifusion Nacional de Colombia on 11.680, opening 1700.

Cyprus—Herbert Bluman, North Africa, reports to *Radio Australia* that "This is your Forces' Broadcasting Service, Cyprus," is being heard on 7.220 from 2200; relays BBC news from London 2300; when closing 1500 leaves air with recording of Ted Lewis' "Goodnight." (*It is probable this is old JCKW, Jerusalem, moved to Cyprus.*—K.R.B.)

Czechoslovakia—Prague's 11.76 outlet is heard in England opening 1030 (is heard earlier on 15.320); *English* heard 1245 on 11.76 and 1445 and 1645 on 9.55. (Pearce)

Denmark—Tests on Denmark's 9.520 outlet at 1230-1400 have been heard at good level in South Australia. (Gillett) Also heard in England. (Pearce) Heard in Florida at opening, weak, soon faded out. (Gardner)

The *Danish Radio*, Copenhagen, has informed Worris, N. Y., that the 9.520 outlet which tests weekdays (*not Sundays*) 1230-1400 is non-directional which explains at least in part why has been inaudible usually in America; the 15.165 channel, used 1100-1230 (*except Sundays*), is beamed to the United States-Canada and is well received in America. Station expects to

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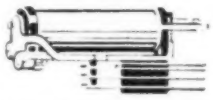
STANDARD DC TELEPHONE RELAYS

Stock No.	Operating Voltage	Coil Resistance	Contacts	Manufacturer	Net Each
R-101	24V	1500.	DPST (NO)	Auto. Elec.	$1.35
R-102	24V	400.	SPDT	Auto. Elec.	1.10
R-103	24V	DUAL 1000	3PST (NO)	Auto. Elec.	1.35
R-105	24V	600.	3PST (NO)	Clare	1.20
R-106	24V	1300.	3PST (NC)	Clare	1.25
R-152	12V	50.	DPDT SPST (NO)	Guardian	1.10
R-153	12V	200.	SPDT-SPST (NO)	Stromberg	1.25
R-154	12V	200.	SPST (NO)	Clare	1.20
R-155	12V	100.	SPST 4NO4NC)	Auto. Elec.	1.15
R-158	6V	50	4PST (NO)	Stromberg	1.10
R-159	6V	50	DPST (NO)	Stromberg	1.10
R-160	6V	12	3PDT 3PST (NO)	Auto. Elec.	1.05
R-161	6V	10	3PST (2NC 1NO)	Auto. Elec.	.90
R-121	150V	5000.	2PST (NO) SPDT	Clare	1.65
R-123	150V	6300	SPST (NO)	Clare	1.75
R-602	150V	6500	3PST (NO)	Clare	1.75
R-515	24V	750	SPST (NO)	Clare	1.25
R-517	12V	250	DPST (NO)	Clare	1.20
R-519	250V	14000.	SPDT	Auto. Elec.	1.95
R-520	250V	14000	DPDT	R B M	2.10
R-521	32V	1000	DPDT	Kellogg	1.20
R-166	24V	DUAL 200.	DPDT SPST (NO)	Stromberg	1.59
R-168	24V	DUAL 200.	4PST (NO)	Auto. Elec.	1.20
H-240	250 350V	40000.	DPST (NO)	Auto. Elec.	2.95
H-241	48V	650	SPDT SPST (NO)	Clare	1.25

TYPE 18 DC TELEPHONE RELAYS

Stock No.	Operating Voltage	Coil Resistance	Contacts	Manufacturer	Net Each
R-109	24-48V	4000	SPDT	Auto. Elec.	$1.50
R-110	24-32V	3500	SPDT	Auto. Elec.	1.50
R-112	90-120V	6500	SPST (NC)	Auto. Elec.	1.75
R-114	24V	500	4PST (NO)	Auto. Elec.	1.30
R-603	24V	400	DPST (NO)	Auto. Elec.	1.25
H-238	24V	150	DPDT SPST (NC)	R B M	1.25
H-239	24V	180	DPST (NO)	Auto. Elec.	1.25



SEALED DC TELEPHONE RELAYS

Stock No.	Operating Voltage	Coil Resistance	Contacts	Manufacturer	Net Each
R-125	24V	300.	DPDT	Clare	$2.75
R-126	90-120V	2000	DPDT	Clare	3.00
R-504	24-70V	2800	SPDT	GE C103C25	3.00

V TYPE DC TELEPHONE RELAYS

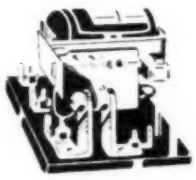
Stock No.	Operating Voltage	Coil Resistance	Contacts	Manufacturer	Net Each
R-164	24-32V	1000	SPST (NO)	W. E.	$1.20
R-512	24-48V	3500	DPDT	W. E.	1.30
R-513	12-24V	300	DPDT DPST (NC)	W. E.	1.20
R-514	4-6V	60	SPDT	W. E.	1.05
R-526	6V	35	DPDT SPST (1NC 1NO)	W. E.	1.05

AC-STANDARD TELEPHONE RELAYS

Stock No.	Operating Voltage	Coil Resistance	Contacts	Manufacturer	Net Each
R-212	90-135V	—	NONE	Clare	$0.95
R-213	5-8V	—	DPST (NO)	Clare	1.50
R-605	24V	—	3PST (NO)	Auto. Elec.	.95
R-606	24V	—	DPST (1NO-1NC)	Auto. Elec.	.95
R-607	24V	—	SPST (NO)	Auto. Elec.	.95

DIRECT CURRENT MIDGET RELAYS

Stock No.	Operating Voltage	Coil Resistance	Contacts	Manufacturer	Net Each
R-132	24V	300	DPDT	Clare	$1.20
R-133	24V	300	NONE	Clare	.60
R-134	24V	250	4PDT	Clare	1.20
R-135	24V	300	SPST (NC)	Clare	1.15
R-137	24V	300	SPDT	Clare	1.15
R-138	24V	300	4PST (NO)	Clare	1.15
R-139	24V	200	4PDT	Clare	1.15
R-140	24V	280	SPDT	R B M.	1.15
R-141	24V	280	3PST (NO)	R B M.	1.15
R-142	24V	400	DPDT	Allied Cont.	1.20
R-143	24V	280	SPST (NO)	R B M.	1.15
R-144	24V	250	SPST (NO)	Allied Cont.	1.15
R-145	24V	300	DPST (NO)	Allied Cont.	1.15
R-146	12V	126	DPST (1NO) (1NC)	Clare	1.10
R-147	9-14V	75	SPDT	Guardian	1.05
R-148	12V	100	DPDT SPST (NC)	Price Bros.	1.10
R-149	6-8V	45	SPST (NC)	Clare	1.00
R-150	6V	30	SPST (NO)	E Z Elec.	.95
R-522	2-6V	2.	SPST (NO)	R B M.	.65
R-523	90-125V	6500	DPDT	Clare	1.90
R-222	12V	100	DPST (NO)	P & B	.95
H-242	24-32V	300	DPDT	R B M.	1.20
H-243	24-32V	300	4PDT	R B M.	1.20



SENSITIVE DC RELAYS

Stock No.	Operating Voltage	Coil Resistance	Contacts	Manufacturer	Net Each
R-218	4-6V	1800	SPDT	Kurman 220C	$1.95
R-220	75V	5000	SPDT	Allied Cont.	1.20
R-221	18-24V	5000	SPST (NO)	Allied Cont.	1.15
R-174	250V	5000	DPST (NO)	G M	1.85
R-175	350V	11000	DPDT DPST (NO)	G M	2.95
R-176	24V	250	DPST (NO)	G M	1.50
R-177	24V	300	4PDT	G M	1.65
R-600	8-12V	5000	SPDT	S. Dunn KS	2.10
R-507	24-48V	1000	SPDT-DPST (NC)	Guardian	1.15

TYPE BO DC RELAYS

Stock No.	Operating Voltage	Coil Resistance	Contacts	Manufacturer	Net Each
R-169	24V	250	SPST (NO)	Allied Cont.	$1.95
R-171	24V	230	DPDT	Allied Cont.	2.15
R-172	5-8V	30	DPDT SPST (NO)	Allied Cont.	1.70
R-173	2-6V	5	SPST NO)	Allied Cont.	1.25
R-529	24-48V	1000	DPDT	Allied Cont.	2.50

TYPE BJ QC RELAYS

Stock No.	Operating Voltage	Coil Resistance	Contacts	Manufacturer	Net Each
R-204	12V	65	DPST (NO)	Allied Cont.	$1.15
R-205	24V	260	DPDT	Allied Cont.	1.25
R-224	12V	75	SPST (NO)	Allied Cont.	1.15
H-237	27V	230	DPDT	Allied Cont.	1.25

HEAVY DUTY KEYING RELAYS

Stock No.	Operating Voltage	Coil Resistance	Contacts	Manufacturer	Net Each
R-208	28V DC	150	SPST (NO) 10A	Guard 36471	$1.05
R-244	75V AC	265	SPST (NO) 20A	Leach 1327	1.75
R-206	24V DC	150	5PDT 3 AMP	P&B KL	1.20
R-207	24V DC	210	4PDT 3 AMP	P&B KL	1.10
R-219	50V DC	1500	DPST (NO) 15A	P&B SP	1.25
R-217	115 AC	600	SPDT 10 AMP	St. Dunn 1XAX	2.25
R-525	24V DC	200	DPDT 10 AMP	Guard 34464	1.25
R-508	110 AC	600	SPDT-6 AMP	Guard 37189	1.95
R-506	24 V DC	300	DPST (NO) 6A	—	.95
R-510	24 V DC	200	3PDT 10 AMP	Guard 516983	1.05
R-604	24 V DC	200	SPST (NO) 30A	St. Dunn B2A	1.25
H-608	115 AC	—	SPST (NO) 20A	St. Dunn 1HXX	2.25
R-620	12V DC	35	3PST (NO) 10A	Guard BK2	1.05
R-223	28V DC	150	SPST (NO) 40A	Price Bros.	1.35
H-230	12 24V DC	80	DPST NO) 10A	—	1.20
H-231	24V	230	DPST (NO) 5A	R B M	1.15

DC-TYPE 76 ROTARY RELAYS

Stock No.	Operating Voltage	Coil Resistance	Contacts	Manufacturer	Net Each
R-197	9-16V	70	DPDT	Price Bros.	$1.65
R-198	9-16V	125	6PST (3NO 3NC) SPDT	Price Bros.	1.65
R-199	24-32V	250	SPDT DPST (NC)	Price Bros.	1.65
R-200	24-32V	275	3PDT SPST (NC)	Price Bros.	1.65
R-201	24-32V	250	DPST (NO) SPDT (NC) DPDT	Price Bros.	1.65
R-601	9-14V	60	3PST (NO)	Price Bros.	1.65

DIRECT CURRENT KEYING RELAYS

Stock No.	Operating Voltage	Coil Resistance	Contacts	Manufacturer	Net Each
R-190	12V	65	DPDT 10 AMP	Advance Elec. Type 2000 A	$1.15
R-191	28V	125	DPDT 10 AMP	Guardian	1.20
R-192	12V	44	3PDT 10 AMP	Allied Cont. Type NBS	1.35
R-193	5-8V	11	DPDT 10 AMP SPST (NO)	Leach Type 1027	1.05
R-194	24V	265	DPST (NO) 10 AMP	Leach Type 1054SNW	1.25
R-195	6V	32	DPDT 3 AMP	G E Co.	1.15
R-196	12V	50	DPDT 10 AMP SPST (NC)	Guardian	1.15
R-242	24V	170	SPDT 2 AMP	Leach Type 1253DEW	1.25
H-236	5-8V	18.5	SPDT 10 AMP	Leach HFM	1.05

CUTLER HAMMER HEAVY DUTY CONTACTORS

Stock No.	Operating Voltage	Coil Resistance	Contacts	Manufacturer	Net Each
R-178	24V DC	100	SPST (NO) 100A.	6141H34A	$3.65
R-179	6V DC	6.5	SPST (NO) 50A.	6041H83A	3.00
R-180	12V DC	25.	SPST (NO) 50A.	6041H38	3.25
R-181	24V DC	65	SPST (NO) 100A	6041H8B	3.95
H-232	24V	55.	SPST (NO) 50A.	Metal Cased	3.25
H-233	6V	15	SPST (NO) 50A	Metal Cased	3.15
H-235	24V	70.	SPST (NO) 100A.	Type B6	3.85

DIRECT CURRENT AIRCRAFT CONTACTORS

Stock No.	Operating Voltage	Coil Resistance	Contacts	Manufacturer	Net Each
R-182	28V	80	SPST (NO) 25 A.	Guardian	$1.85
R-183	24V	60	SPST (NO) 50 A.	Allen Bradley Type B6A	2.75
R-184	28V	50	SPST (NO) 100A.	General Elec.	2.95
R-185	24V	100	SPST (NO) 50 A.	Leach 5055ECR	2.75
R-186	24V	132	SPST (NO) 50 A.	Leach 7220-3	2.50
R-187	24V	100	SPST (NO) 50 A.	Allen Bradley	2.95
R-188	24V	200	SPST (NO) 75 A.	Allied Cont.	2.95
H-234	14V	45	SPST (NO) 30 A.	—	1.65

ANTENNA CHANGEOVER RELAYS

Stock No.	Operating Voltage	Coil Resistance	Contacts	Manufacturer	Net Each
R-192	6-12V DC	44	2PDT 10 AMP	Allied-NBS	$1.35
R-231	12VDC	100.	DPDT 6 AMP	G. E.	1.95
R-256	24-32V DC	—	SPDT-DPST (NC) 1KW	Guardian	1.45
R-501	110 AC	4	DPDT (1KW)	G. E.	2.45
R-503	12-32V DC	180	SPDT-5PST	G. E.-500 W.	1.95

COMBINATION PUSH BUTTON AND REMOTE RELAY

Stock No.	Operating Voltage	Coil Resistance	Contacts	Manufacturer	Net Each
H-244	12-24 V DC	Dual 60	SPDT	CR2791 R106C8	$1.65

ADJUSTABLE TIME DELAY RELAY

Stock No.	Operating Voltage	Coil Resistance	Contacts	Manufacturer	Net Each
R-246	115 AC		SPST (NO) or (NC) 10 AMPS	R. W. Cramer 1-120 Sec.	$8.95

DC MECHANICAL ACTION RELAYS

Stock No.	Operating Voltage	Coil Resistance	Contacts	Manufacturer	Net Each
R-245	12V	25	4" Lever	G.M.	$0.95
R-527	6-12V	200.	2" Lever	—	.95

TYPE C.M.S. RELAY

Stock No.	Operating Voltage	Coil Resistance	Contacts	Manufacturer	Net Each
R-511	24V DC	200	MICRO-SW SPST (NO)	Clare	$2.45

DC CURRENT REGULATOR

Stock No.	Operating Voltage	Coil Resistance	Contacts	Manufacturer	Net Each
R-509	6-12V DC	40	SPST (NC)	G. E.	$0.85

LATCH AND RESET RELAY

Stock No.	Operating Voltage	Coil Resistance	Contacts	Manufacturer	Net Each
R-560	12V DC	10	DPDT-10 AMP	St. Dunn-CX-3130B	$2.85

DC-ROTARY STEP RELAY

Stock No.	Operating Voltage	Coil Resistance	Contacts	Manufacturer	Net Each
R-621	6-12V	30.	3 POLE 23 POSITION	W. E.	$10.95

DC-RACHET RELAY

Stock No.	Operating Voltage	Coil Resistance	Contacts	Manufacturer	Net Each
R-230	5-8V	2.	SPDT-DPST (NO)	Guardian	$2.15

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begin regular transmissions in October for Danish-Americans, and by November also with special broadcasts (in *English*) about Danish topics. These periods will be beamed to America, probably around 2000-2200 daily, and most likely will be heard on the 15.165 (beamed) channel. Reception reports should be sent to Danish State Radio, Short-Wave Section, Copenhagen, Denmark. Will have QSL cards available soon.

Dutch New Guinea—Biak Island is being heard in South Australia "spasmodically" until closing between 0700 and 0710 on (announced) 4.895; popular records are played before this closing announcement (in *English*)—"You have been listening to the General Network Station, YDZ, Biak Island, which operates on 4.895. We invite you to listen tomorrow night at the same time." (Gillett) This one has been a "mystery" to Paul Dilg, Calif., for some time—but he identified it as Biak just a few days before I received this confirmation from Gillett.

Egypt—SUX, 7.865, Cairo, is now heard 1030-1630 or later. (Radio Australia)

Eritrea—The AFRS programs reported from neighboring countries as audible on 4.000 were harmonic radiations (since suppressed) of experimental AFRS Asmara transmitter, using 250 watts on 1000 kc. medium-wave. (Bluman, North Africa, via ISWC)

Ethiopia—Radio Addis Ababa, 9.620, is scheduled Sundays 0300-0530; Sundays 0300-0530; weekdays 0600-0700; also re-opens 1045 and probably runs to at least 1130. (Radio Australia)

French Indo-China—Hanoi's old *Radio France* has moved from 6.048 to 6.190; best around 0700. (Radio Australia)

Germany—The widely-reported German station on 15.105, heard with news in German 0930-0945, is DSTB, Munich; relay may be from Soviet-controlled *Berliner Rundfunk* since at beginning of the news period a man announcer says "Hier ist ihr Berlin" (Here is your Berlin). (Kary, Pa.)

The Hamburg outlet formerly 6.115 has moved to 7.290 where it sometimes suffers bad "ham" interference.

Munich stations relaying "Voice of America" broadcasts are scheduled—Munich III, 6.080, Munich IV, 7.250, Munich II, 9.540, and Munich I, 11.870, 1100-1700; Munich III beams to Europe in general, the others to Eastern Europe.

Pearce, England, reports *Radio Munchen*, Nuremburg, on 6.160 with news in German, 1000; now has program different from that on 6.080; during period in German, to 1100, mentions "Hier ist Berlin," which call is also heard on 6.080 in the 1700-1800 radiation.

FOVA, "Den Danske Brigade-Radion," has transmission on 6.225 weekdays 2300-0000 (Sundays 0000-0100), 0600-0700, 0900-1100, 1300-1400; Thursdays runs 1300-1645 in last period. QRA is Den Danske Brigade i Tysk-

(*Continued on page* 191)

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C-81	10	C-88	4-16	200	3.45
C-82	10	C-89	4-16	250	5.35
C-83	8	C-90	3-14	300	5.85

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Type 116: mounted; 115 V. input, 0-135 V. output @ 7.5 amps. 1.0 KVA.... 23.00

Type 116U: unmounted; 115 V. input, 0-135 V. output @ 7.5 amps. 1.0 KVA 19.00

Type 1126: 115 V. input, 0-135 V. output @ 15.0 amps. 2.0 KVA..... 46.00

Type 1226: 230 V. input, taped at 115 V. 0-270 V. output @ 9.0 amps. 2.4 KVA 46.00

Type 1156: 115 V. input, 0-135 V. output @ 45.0 amps. 6.1 KVA..... 118.00

SCOPE OR TELEVISION TRANSFORMER

Primary 115/230 VAC 60 cycles

Secondary Windings { 355 V. @ 250 Ma. / 710 V. @ 200 Ma. / 1420 V. @ 170 Ma. / 385 V. @ 20 Ma. / 5500 V. @ 2 Ma.

Fully shielded. A big special, only..... $9.95

DM—43A DYNAMOTOR

Manufactured by G. E., New. Input 24 V. @ 23 amps. 7500 RPM; output 515/1030/2/8 V. @ 215/260 milliamps; filtered. Special $2.95

CORNELL-DUBILIER TYPE EB 9160

16 Mfd. 450 W. V. Electrolytic in can with mtg. nut. Special 79c

POTENTIOMETER WIRE WOUND

100,000 ohm, precision made. G.R type, 25 watt, 5½" diameter. Brand New. $1.95

SELSYN MOTORS

115 Volt AC 60 cycles. Transmitters only. Can be used to turn small beam antenna or as indicators only. 3½" Diameter x 5½" High. Shipping Weight 10 lbs. Special per Pair— $5.95

TUBES

3C24 Triode 100 Watts output: 6.3 Volts 3 amp. Filaments 2000 Volts plate @ 75ma. Each 39c.....10 for $3.50

2x2/879 Rectifier 2.5 Volts 1.5 amp. ..... .49

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For Small Transmitters. DC Voltage Ratings are Approx. Values Obtained at Output of a 2 Section Choke Input Filter. Using Mercury Vapor Rectifier Tubes. Pri. is for 115 V. 60 cy.

Type No.	Sec. Rms. Volts	Sec. DC Volts	DC Sec. MA.	Dimensions H.	W.	D.	Price Each
P 57	660–660†	500	250	4⅝	3 13/16	4⅜	$5.35
	550–550	400					
P 58	1080–1080	1000*	125	4⅝	3 13/16	5	7.20
	500–500	400	150				
P 59	900–900	750	225	4⅝	3 13/16	5⅛	6.00
	800–800	600					
P 67	1450–1450	1200	300	5¾	6⅛	4	17.85
	1175-1175	1000					
P 68	2100–2100	1750	300	5¾	6⅛	4¼	21.30
	1800–1800	1500					

* For dual operation with simultaneous use of both sec. ratings.
† Has 40-volt bias tap.

FILAMENT TRANSFORMER

Primary 115/230 volt 60 cycle. Secondary 5 volts at 15 Amps., 5000 volt insulation. Swell for 35T, 75T, 100TH, 250TH, HK-54, etc. Completely shielded dimensions 4¼ x 5 x 5⅛. Net Weight 10 lbs. Special $3.95

2½ Volts C.T. @ 10 Amps. 7500 Volt RMS Type 40..... 2.40

6.3 Volts C.T. @ 3 Amps. 2500 Volt RMS Type 46..... 1.65

10 Volts C.T. @ 10 Amps. 3000 Volt RMS Type 316..... 4.50

SHURE X-TAL MIKE & STAND

Made to list for $16.00
Our Special Price..... $5.50

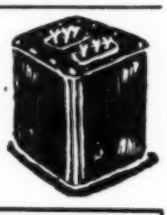
HEINEMAN CIRCUIT BREAKER

Magnetic Type 5 Amp. Size 95c

SOCKETS

Low Loss Steatite Wafer Sockets for 829, 832, and 813 Tubes .....Each 73c

PLATE TRANSFORMER



Primary 115/230 Volt, 25-60 cycle. Secondary 820 Volts Center Tapped at 775 Ma. Hardly any voltage drop at 950 Ma. Completely shielded. Dimensions 6⅝ x 6⅝ x 7⅛. Net weight 36 lbs. Special $7.95

OIL FILLED CONDENSERS

1	Mfd. 600 Volt D.C. Sprague.....	$ .49
8	Mfd. 1,000 Volt D.C. Tobe.....	1.69
0.5	Mfd. 600 Volt D.C. Bathtub. Each	.19
	10 for	1.50
7.5	Mfd. 330 Volt A.C. G.E.	.98
2	Mfd. 10,000 Volt D.C. C. D.	13.95
1	Mfd. 750 V. Sprague.....	.25
Dual .1	Mfd. 600 V. CD Type DYR, each	.19
	Per 100	10.00

BIAS TRANSFORMER TYPE KS 8779

Completely shielded, Insulator Terminals.
Primary 115 Volts 60 cycle
Secondaries 180 V. @ 20 Ma.
300 V. @ 20 Ma.
6.3 V. @ 1.2 amps.
5.1 V. @ 7 amps.
Special $1.95

HEAVY DUTY CHOKE

6 Henries at 550 Ma. 28 Ohms DC Resistance. High voltage insulation. Completely shielded. Dimensions 5½ x 4½ x 5⅝. Net Weight 15 lbs. Special $4.95

STANDARD STEEL CHASSIS

13 x 17 x 3 Black Crackle $2.22

13 x 17 x 4 Black Crackle 2.58

11 x 17 x 3 Black Crackle 1.86
Made of 1/16 inch steel

RELAYS—CS DIFFERENTIAL

Dual coil with armature pivoted between coils. All contacts normally open. Operates 220-250 Volts. 8000 Ohms each coil, contacts S.P.D.T. Controls rated 2 amps. at 110 VAC. Ideally suited for balanced or bridge type circuits where limited current or power is available. Will withstand 12 G Vibration up to 60 cycles at 35,000 feet altitude. Special low price 88c

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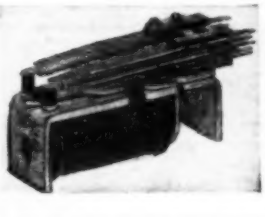
Shielded Phone Plug.....	$0.30
10 for	2.50
Arc 5 Banana Plugs. Per Doz.....	.10
Per 100	1.00
⅛ Amp. 3 AG Fuses. Per Doz.....	.25
1 Amp. 3 AG Fuses. Per Doz.....	.25
1/100 Amp. 8 AG Instrument Fuses. Per Doz.	.50
110 V. Pilot Assembly.....	.39
6 V. Pilot Assembly.....	.19
¼ Watt Neons Double Contact Bayonet Base	.20
Per 100	15.00



MULTIPLE CONTACT

Telephone Type #882—2 windings. Each 125 ohms. #881—Single winding. 12500 ohms. 49c

WIRE

No. 10 Copper Enamel, 100 Ft. Lengths, Each	$1.75
No. 12 Copper Enamel, 100 Ft. Lengths, Each	1.25
No. 14 Copper Enamel, 100 Ft. Lengths, Each	.83
300 Ohm, Twin Lead Plastic covered, per 100 Ft.	1.95
RG-59U 72 Ohm Coaxial Cable, 7c per Ft., per 100 Ft.	6.75

If not rated 25% with order, balance C.O.D. All prices F.O.B. our warehouse New York. No order under $2.00. We ship to any part of the globe.

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Within the Industry

(*Continued from page 28*)

Kende who for the last five years served as assistant export manager in charge of dealer business for *Montgomery Ward & Co.* He will maintain headquarters at *Admiral's* Chicago plant. A sub-office will be set up at the *Admiral Corporation New York City Distributor Division.* In addition, all company distributor facilities will be utilized in the New Orleans, Los Angeles, San Francisco, Seattle, Boston, Philadelphia, and Baltimore areas.

* * *

KENNETH B. WARNER, W1EH, secretary and general manager of the American Radio Relay League and editor of the ARRL's official organ "QST" passed away September 2 at his West Hartford home, of coronary thrombosis.

Known the world over as a spokesman for amateur radio interests, Mr. Warner's passing came as a shock to hams both here and abroad. At the time of his death he was making preparations to attend the ARRL National Convention in Milwaukee over the Labor Day weekend.

Mr. Warner, who was born in Cairo, Illinois, celebrated his 25th anniversary as managing secretary of the League in 1944. He was a member of the Institute of Radio Engineers, and an honorary member of many amateur radio societies. In 1925 Mr. Warner helped form the International Amateur Radio Union, and a few years later, the IARU was changed to its present form—an international association of amateur radio societies. From that date, as secretary of the headquarters society of the Union, Mr. Warner functioned as secretary of IARU.

In his death radio amateurs have lost a friend and champion. RADIO & TELEVISION NEWS joins his many friends in extending our sincere sympathy to his family and associates.

* * *

THE J.F.D. MANUFACTURING CO., INC. of Brooklyn has announced the formation of the *J.F.D.* Antenna Installation Department.

The department will offer free advice to all servicemen in the analysis and solution of their TV-FM antenna installation and reception problems. This new service is unique in being the first department of its kind supported by an antenna manufacturer for the sole benefit of its customers.

The new service is an outgrowth of the company's antenna installation forums which are now being conducted in television centers all over the country. Mr. Friedman will be in charge of the newly-created department.

Inquiries from servicemen should be addressed to *J.F.D.* TV-FM Antenna Installation Service Department, c/o *The J.F.D. Manufacturing Co., Inc.*, 4110 Fort Hamilton Parkway, Brooklyn 19, New York.

* * *

A. C. GABLE has been appointed division engineer for the Industrial and Transmitting Tube Division of *General Electric Company's* Tube Division.

In his new position Mr. Gable will be responsible for the division's design and application engineering and standardizing activities. He was formerly assistant engineer of the division and has been associated with *General Electric* since his graduation from Georgia Tech in 1929.

He was transferred to the Vacuum Tube Engineering Department in November of 1930 and became a section leader on rectifier tubes in 1931. Responsibility for ignitron and thyratron engineering was added later. He continued in that work in the Tube Division until he was given a new assignment as administrative assistant.

* * *

AMY, ACEVES & KING, INC. of New York City has been awarded the contract to provide television outlets in all 3008 apartments of the new Fresh Meadows Rental Housing Development at Flushing, New York.

This installation will provide television, AM and FM outlets for all apartments in the 2 thirteen-story, 68 three-story, and 70 two-story buildings in the new housing project of the *New York Life Insurance Company.*

The company's master antenna systems will provide tenants complete television coverage without the usual arrays of many antennas and lead-ins on the exterior of the buildings. All that will be required of the television set owner is to plug in the set's antenna connection into the built-in wall receptacle.

* * *

JAMES M. KERBEY is the new general manager of operations for *Krich-Radisco, Inc.*, well-known New Jersey firm of distributors.

Prior to joining *Krich-Radisco,* Mr. Kerbey was senior partner in the firm *Kerbey, Cook and Lamson,* industrial engineers of Philadelphia and Manila. In 1944 he was appointed manager of accounts and finance of the International Division of *Radio Corporation of America.* Just after VE Day, he was loaned by *RCA* to the government to serve as executive secretary to the Foreign Ecomonic Administration, which had as one of its projects, the setting up of controls for the management of the German electronics industry.

From 1941 to 1944, Mr. Kerbey was director and vice-president of *RCA-Victor Argentina,* Buenos Aires. He has also served *RCA* in China and Japan as well as vice-president of the *RCA Victor Distributing Corporation* in Chicago.

* * *

JAMES I. MINTEER has been elevated to the post of secretary of *Stewart-Warner Corporation* of Chicago succeeding the late A. R. Benson.

Mr. Minteer has been assistant secretary and assistant treasurer of the corporation since 1943. He joined the company in 1942 as fiscal agent of the Green River Ordnance Plant at Amboy, Illinois, the government munitions plant operated by *Stewart-Warner* during the war.

He formerly owned his own mortgage, real estate, and insurance business in Chicago following several years of banking work as trust department manager and subsequent bank liquidation duties for the Illinois State Auditor's Office.

* * *

TELEVISION FUND, INC. was recently organized in Chicago to operate as an open-end investment company specializing in securities in the field of television, electronics, and radio.

Television Fund, Inc. was conceived as a "logical medium for participation in the future of the television industry, which we regard as the most dynamic growth potential available to the American investor," according to Chester D. Tripp who heads the group.

The organization is retaining both an advisory board and a technical consultant in order to keep posted and informed of developments within the television field. George P. Adair, formerly chief engineer of the FCC, Dr. William L. Everitt, head of the Department of Electrical Engineering at the University of Illinois, and Dr. Frederick E. Terman, dean of the School of Engineering, Stanford University are serving on the advisory board. The technical consultant to the fund is *Television Associates, Inc.* of Chicago.

* * *

JOHN P. KEARNEY, is the newly appointed sales manager of the Industrial and Electronics Division of *Kimble Glass, Division of Owens-Illinois Glass Company.*

Mr. Kearney, a graduate of Fordham University, has been closely associated with glass development in the industrial and electronic fields. During the war, as a Navy lieutenant, he was assigned to handle glass problems on electronics for both the Army and Navy in which capacity he supervised developments, designs, and tests. He wrote the joint Army-Navy specifications for cathode-ray tubes and glassware which are still in effect. He also served as a member of the major in-

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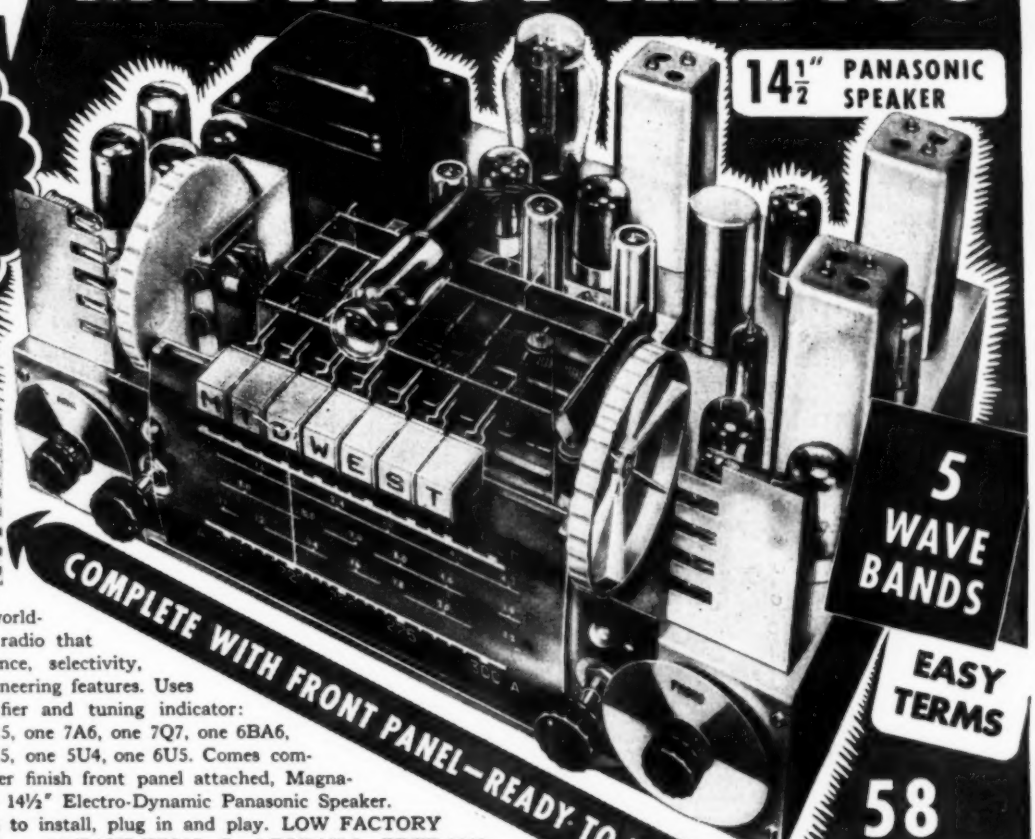
MIDWEST RADIOS

NEW SERIES 16 SUPER DE LUXE AM-FM CHASSIS

30 DAYS TRIAL



14½" PANASONIC SPEAKER

5 WAVE BANDS

EASY TERMS

COMPLETE WITH FRONT PANEL—READY TO INSTALL!

Here is the last word in radio engineering . . . a powerful, world-ranging, magnificently-toned radio that is unsurpassed for performance, selectivity, sensitivity, and advanced engineering features. Uses these latest-type tubes, rectifier and tuning indicator: three 7A7, three 7A4, two 7C5, one 7A6, one 7Q7, one 6BA6, one 6BE6, one 6C4, one 6AL5, one 5U4, one 6U5. Comes complete with satin stripe copper finish front panel attached, Magna-Tenna Loop Aerial and giant 14½" Electro-Dynamic Panasonic Speaker. Requires only a few minutes to install, plug in and play. LOW FACTORY PRICES . . . EASY TERMS . . . 30 DAYS TRIAL. Send TODAY for FREE 1949 Midwest Radio Catalog of separate Chassis and beautiful Console and Table models.

58 OUTSTANDING FEATURES

Including the Exclusive Midwest

FLASH-O-MATIC
Volume and Band Indication

TELEVISION
Audio Switch-Over

FIDEL-A-STAT
Color-Ray Tone Selection

TRI-MAGNADYNE
Coil System

...Plus NO-DRIFT FM and many other features

A Complete Line of FINE RADIOS and RADIO-PHONOGRAPHS . . . Available in SEPARATE CHASSIS Like the POWERFUL SERIES 16 AM-FM Model above or in COMPLETE CONSOLES like this...

Beautiful

SYMPHONY GRAND

AM-FM Radio-Phonograph with TELEVISION Audio Switch-Over and NEW Intermix AUTOMATIC RECORD CHANGER

A Magnificent musical instrument and a masterpiece of cabinet design—the finest Midwest Radio in 29 years of manufacture. Offers world-ranging radio reception and newest automatic Intermix Record Changing Phonograph. Uses Series 16 Super DeLuxe AM-FM Chassis. Giant 14½" Panasonic Speaker; Tri-Magnadyne Coil System; Built-In Loop Antenna. Other luxurious console and table model cabinets available with Series 16, 12, and 8 chassis—on Easy Terms and 30 Days Free Trial.

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ternational vacuum tube development committes during the war.

He joined the *Libbey Glass Division* of *Owens-Illinois Glass Company* in 1946 and transferred to the *Kimble Glass* division in 1947 as Eastern division sales representative.

* * *

RAYTHEON MANUFACTURING COMPANY has purchased at a cost of $1,082,300 certain government facilities constructed during the war at Waltham, Massachusetts.

The facilities include four major and several minor buildings containing approximately 348,000 square feet of manufacturing, engineering, and storage space, including the war-built Power Tube Building. The equipment comprises specialized power tube manufacturing and test facilities, as well as standard machinery, engineering, and office equipment.

Terms of sale require *Raytheon* to give the United States a 20 year right temporarily to take over the facilities, if needed for national defense purposes. This right may be exercised, however, only if *Raytheon* is unwilling or unable to do the work for which the facilities are needed.

* * *

ERIC R. SLAYTON has joined *Audio Development Company* of Minneapolis as sales manager in charge of promotion and distribution of the company's line of electronic and hearing test equipment.

Mr. Slayton came to *ADC* from *Radio Corporation of America's* Victor Division in Philadelphia where he was group sales manager for microwave relay and channeling equipment. His background also includes 20 years of sales and commercial engineering experience with the *Bell Telephone System.*

He received his engineering degree at Pratt Institute and did graduate work at Yale.

* * *

F. P. BARNES has been appointed assistant to the manager of sales for the Transmitter Division of *General Electric Company's* Electronics Department.

A graduate of Stanford University, Mr. Barnes joined *General Electric* in 1937, taking the Engineering Test Course in Schenectady. He subsequently spent a number of years in Seattle, where he specialized in industrial electronics and radio communications for *G.E.*

Well-known in radio and electronics on the West Coast, he taught courses in industrial electronic engineering and radio engineering at the University of Washington. Since January of 1945 he has been a Western District representative for the Electronics Department, covering northern California, the Northwest, and Rocky Mountain areas.

—30—

Marker pips, generated by an auxiliary AM signal generator, then permit exact determination of the location of critical response points, such as the video i.f. carrier and the trap circuit frequencies.

The alignment procedure of the video i.f. system starts with the precise adjustment of the several trap circuits. The method is quite simple and readily effected. Place the vacuum tube voltmeter across the video second detector load resistor and the AM signal generator to the control grid (and chassis) of the mixer tube. Set the generator to one of the trap frequencies and then adjust the proper trap until the vacuum tube voltmeter indicates a minimum reading. The minimum point should be quite sharp because only one frequency or, at most, a narrow band of frequencies is to be attenuated. For each trap circuit, the generator should be set to its frequency and the trap frequency adjusted until the meter indicates minimum passage of the signal through the circuit or maximum attenuation.

An alternate method but one which is not as sensitive as the foregoing is to adjust each trap while observing the results on the face of the picture tube. The vacuum tube voltmeter is not required now. This method operates as follows. Connect the signal generator to control grid (and chassis) of the mixer tube, as in the above method. Increase the generator output until a series of horizontal black bars appear on the screen. Adjust the proper trap (the one for which the signal generator is set) until the bars disappear. Follow the same procedure for each trap circuit.

The trap circuit adjustments should be checked again after i.f. coils (or transformers) have been aligned because of the interaction between these circuits. However, as a start, the foregoing trap alignment must be undertaken.

We are now ready to start the alignment of the video i.f. system itself and the method employed will depend upon the type of system found in the set.

Stagger-Tuned Systems

In stagger-tuned systems, it will be remembered that each coil is peaked to a different frequency, the over-all response being the sum of the responses of the individual coils. To align this system, we first peak each i.f. coil to the frequency specified by the manufacturer. This is accomplished by connecting an AM signal generator to the control grid of the mixer stage and placing a vacuum tube voltmeter across the load resistor of the video second detector. The scale to use is the d.c. volts scale—generally not exceeding 10 volts. For each coil, the generator is set to the frequency

specified by the manufacturer and the tuning slug rotated for maximum indication on the vacuum tube voltmeter.

To run an over-all check on the system connect the output leads of the sweep signal generator to the same points as the AM signal generator. (Note: The AM signal generator remains in position. It will now serve to provide marker signals). In place of the v.t.v.m. we connect the vertical input terminals of an oscilloscope. The sweep generator is adjusted to sweep a band 6 mc. wide, encompassing the complete video i.f. response (25.75 to 21.75 mc. in *RCA* sets, for example) plus frequencies above 25.75 mc. and below 21.75 mc. In this way we are certain of observing the full response. When the equipment is in operation, the response pattern of the circuits under test will appear on the scope screen. (A detailed discussion of the proper methods of utilizing the various types of sweep signal generators and oscilloscopes in aligning television receivers is given on page 46). Check the shape of the curve against the one recommended by the manufacturer in his service bulletin. Check each of the end points of the response curve and the trap frequencies by changing the frequency of the AM signal generator to the frequency of each of these points. Note where the marker pip appears on the response curve and then check with the manufacturer's curve to see if the pip is where it should be.

If any slight adjustments are required, they are made with the sweep generator on so that the effect on the over-all curve will be instantly observed. However, if the curve differs considerably from the recommended curve, it is best to realign the system again.

At no time during the alignment procedure of stagger-tuned systems is it necessary to observe the response of any of the individual stages. Keep the sweep generator output low enough to prevent overloading of the video i.f. amplifiers. If the generator output is too high, it will result in an erroneous appearance of a very flat curve. The proper level is indicated when the "Output" knob of the generator can be made to vary the amplitude of the response curve on the scope screen without appreciably affecting its shape.

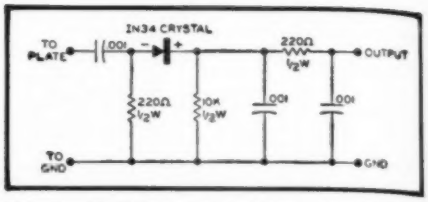


Fig. 7. Circuit of a suitable probe detector.

Another important precaution to observe is to prevent the marker frequency from distorting the shape of the video response curve. This can happen when the output voltage from the marker generator is too high. Keep this voltage as low as possible.

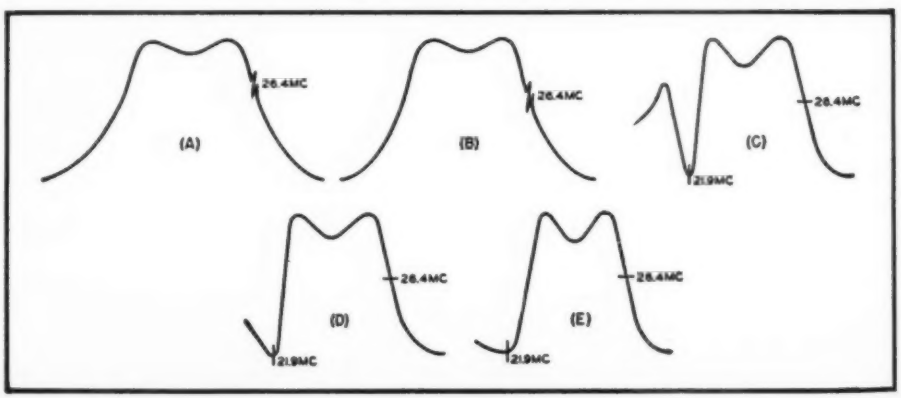
Transformer and Complex-Coupled Networks

When complex and transformer coupling networks are found in the video system, peaking of the individual coils cannot be employed. This is because each stage possesses essentially a 4.0 mc. (or better) width. Under these circumstances, stage-by-stage alignment is required. There are, however, two ways of accomplishing this. In one method, the oscilloscope is connected across the load resistor of the video second detector and the sweep generator travels from the grid of the final video i.f. amplifier back toward the mixer, pausing at each stage while the alignment is carried out. In this method we add to the response curve until, when the sweep generator reaches the mixer, the curve obtained on the screen is the over-all video i.f. response.

In the second method, the response for each stage is viewed individually, with the sweep generator and the oscilloscope moving back toward the mixer together. As a final check the over-all response pattern is observed. The method to be used with any particular set will depend upon the manufacturer's instructions.

To illustrate each method, let us take a set from each group and follow through on a complete video i.f. alignment. The *G.E.* Model 802, shown in Fig. 5, will serve nicely for the first method. The *DuMont* circuit, Fig. 4, will illustrate the second method. In

Fig. 8. Response curves for the circuit of Fig. 4. See text for explanation.



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Step down (or up) power circuit transformer double wound 230V input 50-60 cycle, to 115V output, .250KVA. Weight 17 lbs. **$7.95**

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Step down (or up) transformer, 200V center tapped to 110V; 60 cycle; cap. V.A. 50; metal case, black wrinkle finish; 7 lbs. **$3.95**

AMERTRAN FILAMENT TRANSFORMER

5V-CT-6.5 amp. 115V-60 cycle AC..... **$1.95**

POWER TRANSFORMERS

Current Rating	Sec	Fil	Case	Price
40 Mil	350V CT	6.3V CT-5 amp 5V-3 amp	Half Shell	**$1.95**
		Electrostatic Shield		
60 Mil	550V CT	6.3V-5 amp 5V-3 amp	Full Shell upright	**2.95**
		Electrostatic Shield		
100 Mil	700V CT	6.3V CT-4 amp 5V-3 amp	Full Shell Univ. Mtg.	**3.45**
200 Mil	800V CT	6.3V-6 amp 6V-4 amp	Univ. Mtg.	**4.95**

RADAR JAMMING TRANSMITTER

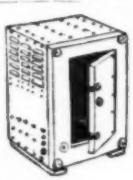
Ultra High Frequency
Band width 3½ meg. wide

1—931A
2—6AC7
1—6AG7
2—703A
1—807
2—5R4GY
1—2X2

Range 500-700 Meg.

Simple to convert to many uses. Has 10 tubes, contains blower and motor to cool tubes. **Brand New** and complete with all tubes. Weight approx. 50 lbs. Size 21" l. 10½" w. 7¾" h. in metal case. Special—While they last.. **$19.95**

Standard Rack Cabinets



Heavy gauge steel, gray crackle finish; panel opening 19" wide, 27" high... **$12.95**

Blank Calibration Books

For BC 221—Frequency from 125KC to 20000 KC printed in .10 divisions—68 pages, aluminum cover, spiral bound..... **$1.50**

Navy Standard Battery

Made by Gould Storage Battery Corp. 6 volt 15 amp hour. Excellent for motors, motorcycles, amateurs, experimenters, radio servicemen, etc. Shipped dry, with complete instructions for charging. 4⅝" wide, 4¾" deep, 6¾" high. Shipping weight 12 lbs. While they last..... **$4.95**

Battery Acid—1275 Sp. Grav.

Can be used in any storage battery—in hermetically sealed bottles.

36 oz. bottle..... **79c**
92 oz. bottle..... **$1.95**

CONDENSERS

G.E.	0.35MFD	5000V	**$1.50**
G.E.	1MFD	2000V	**.75**
Sprague	1MFD	3600V	**.95**
Sprague	3MFD	4000V	**5.95**
Sprague	1MFD	1000V	**.39**
Sprague	0.5MFD	1500V	**.29**
Aerovox	.02MFD	8000V	**1.49**
Aerovox	2MFD	3000V	**2.95**
C. D.	.05MFD	200V	**.19**
Solar	.25MFD	2000V Bathtub	**.39**

WESTERN ELECTRIC CRYSTALS 1N23, **35c** each; 3 for..... **$1.00**

HIGH POWER quartz Crystal units, type CF5, 5000KC. Complete with holder..... **1.95**

ANTENNA for SCR522..... **69c**

TRIODE 24G/3C24

100 W output. Fil. 6.3V-3A-Plate dis. 25W max plate volts 2,000. Max Ma 75. Here is a real bargain in surplus tubes. One of these tubes will give 100 watts output. Two of them will take ¼ kw. input. Stock No. 3C24—Each..... **39c**
10 for..... **$3.50**

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ALL BRAND NEW

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SPECIALS

Westinghouse Bakelite Case

2"	Round 0-10V-AC-DC	**$2.75**
2"	Round 0-30 Mil DC	**2.25**
3"	Round 0-1 Mil DC with bad & good colored scale; can be used in tube checker	**Each $3.45**
3"	Square 0-3 amp RF	
3"	Square 7.5 V-AC	
3"	Round 0-15 Mil DC	
3"	Round 0-35 Mil DC	
3"	Round 0-50 Mil DC	
3"	Round 0-100 Mil DC	
3"	Round 0-150 Mil DC	
3"	Round 0-200 Mil DC	
3"	Round 0-150 V AC	
3"	Round 0-300 V AC	
4¼"	Round 0-150V DC	**4.95**
4¼"	Square 0-300 amp DC complete with shunt and leads	**7.95**

WESTON Bakelite Case

2"	Round 0-75 amp antenna current Indicator with external couple	**$2.75**
2"	Round 0-10V output, portable; in small wooden case	**4.95**
2"	Round 0-500V DC external multiplier	**4.75**
3"	Round 0-3 amp RF surface mount	**3.75**
3"	Round 0-5 amp external thermo couple	**8.50**
3"	Round 0-150V AC 400 cycle	**3.45**
3"	Square 0-130V AC	**3.45**
4"	Square 0-20 Mil DC	**4.75**
4½"	Round 0-5 amp AC with a 0-200 amp scale	**3.95**

G. E. Bakelite Case

2"	Round 0-15V AC-DC	**$2.50**
3"	Round 0-100V DC	**2.75**
3"	Round 0-500 Mil DC	**3.45**

WESTERN ELECTRIC Bakelite Case

3"	Round 0-1000 Mil DC	**$2.25**
3"	Round 100-0-100 Mil DC	**3.45**
3"	Round 20 amp DC charge & discharge	**3.45**

MISCELLANEOUS

3"	Round Beede 0-1000 Mil DC.	**$ 1.95**
3"	Round Triplett 0-150V AC...	**3.45**
3"	Round Burlington 0-75 amp AC	**3.45**
	Roller Smith portable lab 0-15V DC with handle; 5½x6x3½....	**19.50**
	Roller Smith portable lab 0-150 Mil DC with handle: 5½x6x3½.	**19.50**

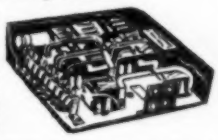
RCA-CRV-51019 Hand Sets self contained battery operated. Uses 4 pen light batteries excellent for Television Antenna installation. Sold in pairs only..... Pair **$15.00**

TS-10P Sound power handsets in original export packing. Each **$15.00**
2 for **$27.95**

WESTINGHOUSE PHOTO CELL

Photox, ¼ mil. D. C. output. Brand New. Special **$1.95**

Voltage Regulator



G.E. 110 to 220V AC, 400 cycle, single phase-.15 amp-20 W; 0-7.2 ohms/2.75 amp; black wrinkle finish metal case..... **$4.95**

Transtat Voltage Regulator

Type RH 115V AC, 400 cycle .72-KVA-output 75 to 120 V @ 6 amp. black wrinkle finish metal case. Weight 11 lbs... **$2.45**

IFF EQUIPMENT

1293B Signal Corp Scope Unit

Consists of 5"Cathode Ray Tube and 24 Tubes

1221A Indicator consists of high & low Voltage supply—8 tubes, electric eye & Selsyn indicator 110V-60 cycle AC—can be converted into an excellent scope. Shipping weight 500 lbs. Brand New in Original Case. Special..... **$49.50**

Oscilloscope

3"—BC991B—can be rack mounted; operates on 6VDC or 110VAC. Complete with 2—6H6; 4—6SF5; 1—6SJ7GT; 1—6SL7GT; 2—5Y3GTG; 1—3P1; in original export packed cases.

Brand New.... **$49.50**

COMPLETE SET of spare tubes same as above plus 1 extra 3P1 in export packed case..... **$12.50**

BC-645 X-MITTER-RECEIVER 450 MC—15 TUBES

Brand New

Can be easily converted for phone or CW 2 way communication. Covering the following bands: 420-450 MC ham band, 450-460MC for fixed or mobile: 460-470MC for citizens: 470-500 MC television experimental. Size 10½x13½x4¾. Contains 15 tubes—4-7F7—4-7H7 — 2-7E6 — 2-6F6 — 2-955 — 1-WE-316A door knob.

Here is what you get:

BC-645 with 15 tubes
PE-101C Dynamotor
Control Head
Instruction Book

$12.95 Complete

All Mdse. new unless otherwise specified

Prompt Delivery—25% deposit required on C.O.D. order. Shipped F.O.B. New York. Write Dept. RN10

MICHAEL STAHL, INC., 39 VESEY ST. Worth 4-2882 New York 7, N. Y.

each instance we will assume that the traps have already been properly adjusted.

In the *G.E.* system, the vertical input leads from the oscilloscope connect across R_1. This is the video second detector load resistor. The sweep generator is connected between control grid (pin No. 4) and ground of V_3. Marker signals for the alignment are supplied by a separate AM signal generator. Connect the "hot" marker lead through a 50 $\mu\mu$fd. condenser in parallel with the output lead from the sweep generator. The other lead attaches to the chassis. Keep the level of the marker generator as low as possible. Throughout this entire alignment, the contrast control is placed in mid-position.

When the sweep generator is connected to the control grid of a video i.f. amplifier tube, it is, at the same time, connected across the secondary of the interstage transformer feeding that tube. The primary of this same transformer will be found to act as a tuned trap, producing a hole in the alignment curve as viewed on the scope unless it is short-circuited or detuned. Place a temporary short across the primary. However, be sure to remove the short after the stage is aligned.

With the equipment thus set up, the response curve for T_1 will appear on the scope screen. Adjust C_7 and C_4 until the response curve possesses the form shown in Fig. 6A. This curve is given by the manufacturer in the service bulletin.

Remove the short from the primary of T_3. The short is not required across the primary of T_2 because the generators themselves are placed here. (The secondary of T_2 serves as a trap. However, it is sharply tuned, and its frequency falls outside the video i.f. response curve. Consequently it need not be detuned.) The two generators are shifted to the control grid of V_3. The oscilloscope remains across the load resistor of the video second detector. Now adjust C_5 and C_6 until the response curve on the scope screen appears as shown in Fig. 6B. Note that the curve obtained on the scope screen represents the combined response of T_2 and T_4.

Within the cathode leg of V_2 a resonant circuit (L_1 and C_1) is included. The purpose of this circuit is to reduce the overshoot which occurs to the left of the response curves, Fig. 6A and 6B. L_1 is adjusted by spreading or squeezing its turns for minimum amplitude of the overshoot. (L_1 is peculiar to this receiver and may not appear in other transformer-coupled circuits).

To align T_2, connect both signal generators to the control grid of V_1. Place a short across the primary of T_1. Adjust C_3 until the response curve appears as shown in Fig. 6C. Now remove the short from T_1 and connect both signal generators to the control grid of the mixer. Adjust C_1 and C_2 until the response curve appears as shown

in Fig. 6D. (The response of T_1, by itself, is 5.0 mc. wide to permit amplification of both video and audio signals. Fig. 6D, however, is the response of the entire system and hence the 5.0 mc. spread of T_1 is not visible.) Slight adjustments may be performed to improve the over-all response. However, if the response is considerably off at any point, the entire alignment procedure should be repeated. Some servicemen prefer to align the entire system at once, bypassing the stage-by-stage procedure. This is possible, but only by one who is thoroughly experienced. Otherwise, it is best to follow the procedure as outlined to obtain *best* results in the *shortest* time.

To illustrate the second stage-by-stage procedure we will use the *DuMont* RA-102 television receiver. See Fig. 4. The manufacturer recommends individual stage alignment and this requires that the scope move forward with the signal generators. However, before we start, we must devise some method of rectifying the signal so that it can be applied to the oscilloscope. The output frequency of the signal generator sweeps back and forth at the rate of 60 times a second. When the signal travels through the i.f. system and reaches the video second detector, it is converted (rectified) to a 60 cycle-per-second voltage. This can be fed then to the oscilloscope and a visual response pattern produced. However, when we wish to determine the response of a single intermediate stage (except the last one), it becomes necessary to connect the scope within the video i.f. system itself. Since the vertical amplifiers within the scope will not pass the high video i.f. frequencies, some type of probe detector must be employed to convert this signal down to its sweeping frequency—60 cycles. A probe detector circuit suitable for this purpose is shown in Fig. 7*. The output leads of the probe connect to the vertical input terminals of the scope.

To start the alignment, connect the sweep generator to the control grid of V_3 (Fig. 4). The signal generator which is to provide marker signals is connected to the same point using a 50 $\mu\mu$fd. condenser. Since we are aligning the final video i.f. coupling network preceding the video second detector, the vertical input terminals of the scope are connected across the video detector load resistor. In this circuit this is R_1. It would also be feasible to connect the scope to the control grid of any video-frequency amplifier following the video detector or even to the control grid of the cathode-ray tube itself. The point chosen is the one most convenient. Adjust L_2 and L_3 until the response curve of Fig. 8A is obtained on the scope screen. The marker signal is set to 26.4 mc., the video carrier i.f. value.

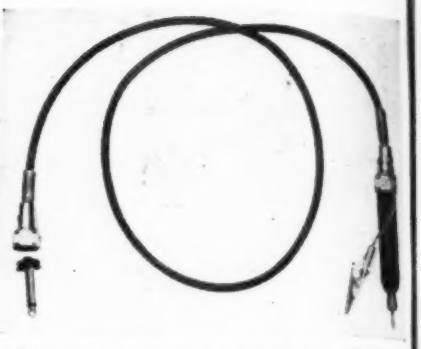
* The components of this circuit should preferably be placed within a probe designed along the lines of the unit described by Donald F. McAvoy in "R.F. Probe Design," RADIO NEWS, March, 1946. RCA manufactures a crystal probe which is ideal for this work.

It should appear at the point indicated in Fig. 8A.

The next stage is now ready for alignment. Shift the sweep and marker signal generators to the grid of V_2, pin 1. Place the probe detector at the plate of V_3, with the output of the probe applied to the vertical input terminals of the oscilloscope. The marker signal generator remains set at 26.4 mc. Observe the response pattern on the scope screen and adjust L_5 and L_6 until the pattern of Fig. 8B is obtained. Note that this is solely the response of the coupling network between V_2 and V_3.

Now shift the two generators to the control grid of V_1 and place the probe detector at the plate of V_2, pin 5. L_3 and L_4 are adjusted until the pattern of Fig. 8C is obtained. C_2 is the sound trap adjustment and should be checked to determine whether its setting is correct. With the marker signal generator, check the 21.9 and 26.4 mc. points on the curve. They should appear at the places specified in Fig. 8C.

The generators go next to the grid of the mixer tube. The probe detector is placed at the plate of V_1, pin 5. L_1 and L_2 are adjusted to obtain the curve of Fig. 8D and the setting of C_1 is checked to determine if the attenuation at 21.9 mc. is as high as possible. As a final check, the over-all curve should be observed and this is done by leaving the generators at the control grid of the mixer and connecting the vertical input leads of the scope across the video detector load resistor or at some other suitable point in the video frequency system (as noted above). The probe detector is discarded for this step. Check the frequencies at various points on the response curve using the marker generator. (Fig. 8E.)



This crystal probe, designed by RCA to extend the frequency range of the "Volt-Ohmyst," can be readily adapted as a probe detector. When used for this purpose, the output of the probe is fed to the vertical input terminals of the oscilloscope.

A point to remember when aligning the video i.f. system stage-by-stage concerns composite i.f. stages or those which amplify both audio and video i.f. signals. These stages must have a sufficiently wide response to pass both signals without unduly attenuating one or the other. Their bandpass is usually 5.0 mc. and the response should be checked carefully to make sure that the audio carrier receives full amplification.

Servicing of the video i.f. system will be delayed until the video detector and video-frequency amplifiers have been analyzed. All these stages fall into the same servicing package and will be covered as a single unit.

(To be continued)

LOW COST ATTENUATION PADS FOR B.C. STATIONS

By LEON A. WORTMAN

NO broadcast station ever seems to have a large enough stock of fixed attenuation pads to cope with the varied requirements and occasions for their use in the daily routine of work. One reason is the cost of commercially manufactured pads.

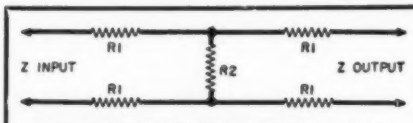
An economical method for constructing such pads of fixed attenuation and impedance was found by assembling, in a few minutes, the unit shown in the photograph. The shield can is a small coil shield that is readily available in most radio supply stores. Five ordinary 1-watt resistors are connected as a symmetrical "H" pad. The resistors are supported by their own wire leads and are brought through the sides of the can through small rubber grommets.

The input and output leads are soldered to terminal tie points bolted to two opposite sides of the can. There is no marking on the can other than the attenuation characteristic in decibels. The input and output look into the same impedances.

An extra refinement, although not essential to performance, is to fill the can with paraffin.

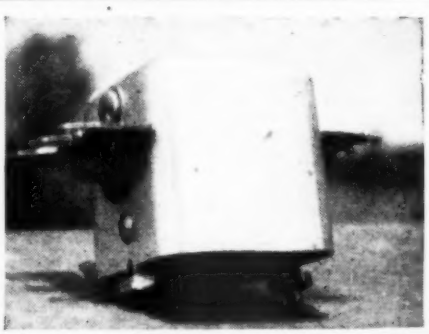
—30—

Circuit diagram and parts values for constructing various attenuation pads for broadcast use. Photograph of completed unit is shown at right.



APPROXIMATE VALUES FOR SYMMETRICAL H PADS
Z=500 OHMS (RESISTIVE)

ATTENUATION DB.	OHMS R1	OHMS R2
3.0	45	1400
6.0	85	670
9.0	120	400
12.0	150	270
16.0	180	160
20.0	200	100
24.0	220	65
30.0	235	30



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Transmitters & Receivers for 10 Meter Mobile Rig

COMPLETE SCR-274-N

Cost Gov't over $600

Conversion Book gives details for low-cost, easy conversion to

- **10 METER MOBILE RIG**
- **20 - 40 - 80 METER BANDS**

$39.50

This sensation of all surplus is not only an ideal 10 Meter Mobile Rig! It's a complete amateur radio station! Here are a few more ways to use the equipment included in this Command Set. The transmitter VFO driver stage gives your BC-375-E higher RF output—as high as 150 watts. Make swell standby receivers with the BC-348 on round-table "rag chews." You get all this equipment: 3 Receivers—190-550 kc, 3-6 and 6-9.1 mc; two transmitters, 4-5.3 mc, 5.3-7 mc; four dynamotors—28 volts DC input; 1 modulator with carbon mike input; two tuning control boxes; one antenna coupling box with r-f ammeter; antenna relay and 5000 volt 50 mmfd. WE vacuum condenser (antenna relay can be used with most rigs); and a complete set of tubes for each unit—29 POPULAR TUBES in all. Mechanical cables for remote tuning of receivers supplied for $1.00 extra. Shipment from our nearest warehouse, East, Mid-West or West Coast.

TUNING KNOBS for local control for receivers, 50c ea. Three for $1.25

6-VOLT DYNAMOTOR

IDEAL FOR MOBILE OPERATION

- **(300 VDC 80 mills) 6-volt DC input**
- **(250 VDC 100 mills) 4 to 5 amps.**

$7.95

Just the dynamotor for that glove compartment 10 meter job. Sturdy, well made. 4"x4"x5" mounting space.

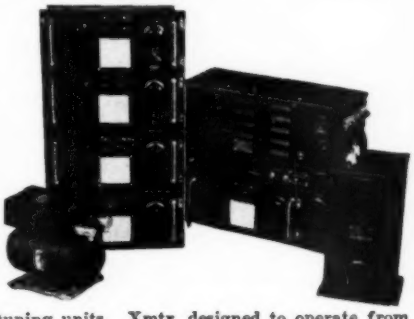
Write for Dynamotor Listing

BC-375-E TRANSMITTER

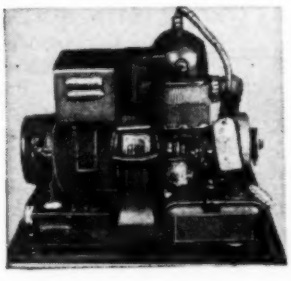
WITH THOUSANDS OF USABLE STANDARD RADIO PARTS

(Gov't cost, $1800)

$49.50 complete



It's been written about and talked about — just the thing for beginner or old-timer; has five tubes, five tuning units. Xmtr. designed to operate from 200 kc to 12 mc. (less BC band). Equipped with antenna tuning unit BC-306-A—variometer and tap switch. Dynamotor (PE-73-C) complete with relay, fuses and filter. Weight approx. 275 lbs. Shipment from our nearest warehouse, East, Mid-West or West Coast.



The Famous "PUTT-PUTT"

GASOLINE GENERATOR (HRU-28)

28 - 32 volts D. C. ONLY $74.50

Single cylinder, 2-cycle gasoline engine with generator that is rated at 2,000 watts direct current, 70 amps. Has unlimited use around a farm; useful as field day power supply. More literature upon request.

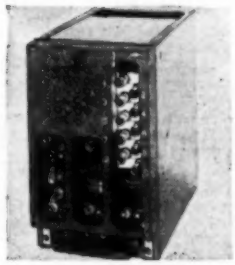
25 WATT FM-TRANSMITTER-RECEIVER

$29.50 for special combination

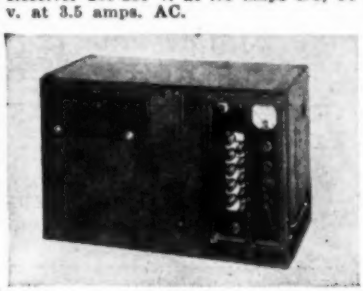
For mobile or fixed station use; easy conversion to 10 and 11 meters.

Schematic diagram and information—how to convert to 110 v. AC and amateur use.

BC-603 RECEIVER (alone) $14.95



10 tube, superhet FM receiver; Foster Seely discriminator, 10 channel; pretuned, push-button selector; optional manual tuning; adjustable squelch control; speaker mounted in receiver; freq. range 20 to 27.0 mc. Small change in RF trimmers will cover 10 & 11 meter bands. POWER REQUIREMENTS — Receiver 260-280 v. at .08 amps DC, 14 v. at 3.5 amps. AC.



BC-604 TRANSMITTER (alone) $19.50

10 channel, crystal controlled, selected by push button. Xmtr. has 7 1619 (2.5v 6L6's) for exciter and FM modulator; 1 1624 (2.5v. 807); final amplified 35 watts; crystal oven for 10 crystals, freq. range 20—27.9 mc. 1 0-100 MA meter measures grid, plate, and ant. current. Price excludes crystals. POWER REQUIREMENTS — Transmitter 500 VDC at .22 amps. DC, 14 VAC at 4 amps. AC.

12 v. Dynamotor for receiver $9.95
12 v. Dynamotor for Xmtr. $12.50

1 box of 80 crystals for above, when purchased with trans., $10.00 per set.

●SAVE C.O.D. CHARGES and speed your order by remitting in full or 25% deposit. Please don't send money for postage, we ship "transportation charges collect". These prices supersede all previous prices. Write every month for BARGAIN BULLETIN.

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Spot Radio News

(*Continued from page* 18)

the BBC will continue to operate their 405-line black and white TV system for many years, since any changeover at this time would be too costly to both BBC and the public, and "any change would prejudice more substantial improvements at a later date."

GROUND-BREAKING CEREMONIES FOR WOR-TV were held recently in North Bergen, N. J., with Jack Poppele, vice president in charge of WOR engineering, Theodore C. Streibert, WOR prexy and Paul Cullum, mayor of North Bergen, attending the event. The station, which is expected to be on the air early in 1949, will operate on channel 9 (186-192 mc.) and will have F. J. Bingley as its chief engineer. Bingley, a director of TBA, was formerly with *Philco* in charge of their telecasting activities.

THE MULTI-MILLION mark has been reached in mobile taxi radio sales, FCC reporting that more than $30,000,000 had been spent for equipment between June 30, 1947 and June 30, 1948.

This large expenditure is certainly a striking tribute to this new service, which a few years ago was nonexistent and today is one of the most important in the commercial communications world.

A UNIQUE USE FOR FM 2-way radio service has been introduced by an electrical shop in Havana, Cuba, for their refrigerator-appliance-radio service trade. Eight cars equipped with 2-way radiotelephone setups, in constant contact with a 60-watt transmitter-receiver in the shop, are able to reach the scene of complaint a few moments after the call for help has been made.

Men assigned to these radio-controlled cars are triple-threat men, having been trained in the servicing of appliance, radio, and refrigeration equipment of the air conditioning or food refrigerator type.

According to Frank Fernandez, vice president and general manager of the shop, G. E. Cubana, who installed the system, the radio service will soon be extended to Santiago de Cuba, and eventually anyone on the island of Cuba will be able to receive service within twenty-four hours via a point-to-point network system.

NEW MULTIPLE STATION OWNERSHIP rules for AM, FM, and TV operators were proposed recently by the FCC. The proposal, which was termed a further step to prevent concentration of control of standard broadcast facilities, lists five rules, which would become effective on January 1, 1953.

According to the rules, no more than seven AM stations could be owned or

controlled by one person or corporation, no person or corporation would be able to serve as stockholder, officer, or director of more than 14 AM stations, FM ownership or control would be limited to six stations and television ownership or control would be limited to five stations.

RADAR HAS COME TO THE AID of the commercial fisherman, serving to locate fish seines, in spite of weather conditions, and speeding up the delivery of perishable fish. The *R. J. Peacock Canning Company* in Maine now use radar equipment aboard their fishing boats to increase the catch of sardines, an extremely perishable fish.

GREAT BRITAIN HAS THE LARGEST number of licensed listeners in Europe, according to a report from the International Broadcasting Union in Geneva. At the end of April there were over 11,000,000 licensees in Great Britain, of which over 49,000 were for television. Germany ranks second, with over 8,000,000 registered at end of December, 1947, including the four zones and the city of Berlin. France follows with over 5,000,000, as of April, 1948, and Italy is next with nearly 2,000,000 listeners, as of December, 1947. Australia, Holland and Belgium follow along with over a million listeners each.

The report also reveals that the plans to extend the French broadcasting network, which were initiated at the time of the liberation, have been completed, and will be placed into operation as soon as funds are voted. Since the beginning of the year, three 20-kw. transmitters, at Nancy, Rouen and Marseilles have been installed. Another 20-kw. station will soon be installed at Bordeau-Neac, replacing the former transmitter at Bordeaux-Carrere. A long-wave (1648 meter) 20-kw. station will soon be placed in operation at Strasburg and will be on the air until the 450-kw. station at Allouis, formerly Radio-Paris, which was destroyed during the war, has been reconstructed.

Short-wave network plans for France were completed early this year and four 100-kw. transmitters are now on the air on 13 and 50 meters, operating from the Allouis center.

Residents of Paris can now listen to FM from a 5-kw. transmitter at Champs-Elysees (formerly Poste Parisien), operating on 69 mc.

In a review of the history of the Italian Broadcasting Service, the Geneva report reveals that amateur broadcasting began in Italy in 1920, and in 1923, the first broadcasting station with a power of 100 watts went on the air. On February 8, 1923, broadcasting became a government monopoly.

Broadcasting headquarters are maintained at Turin and Rome, both equipped with low-frequency installations. A third station is now being built at Milan.

There are 58 studios in use, which are equipped with 36 recorders, 61 playbacks, 366 amplifiers, 140 record molds, 160 amplifiers for music circuits, and 8 mobile trucks.

At Sesto Calende (Milan), there's a checking center which provides measurement and control of frequencies of Italian and other stations, measurement of the field and depth of modulation, collaboration with similar centers in other nations on propagation measurements, and pickup of foreign programs which are relayed by Italian stations.

Reporting on the market for receivers for Germany, IBU says that 650,000 units will be required yearly. A production of about 450,000 is expected this year, if tubes can be supplied. About 85,000 tubes are scheduled for monthly production, but material shortages have reduced these runs to about 70,000.

LICENSING OF NETWORKS BY THE FCC was proposed by former FCC Commissioner Clifford J. Durr, during a meeting of the University of Chicago Religious Radio Workshop. Discussing "Broadcasting in the Public Interest," Mr. Durr said that the present tense relations between networks and the FCC might be eliminated if the Commission had the power to license. This power, permitting a review of programs as now practiced for individual stations, would streamline regulation procedure, he said, and eliminate the fear that FCC rules or regulations are being violated and might cause network cancellations.

RADIO VETERANS AND HAMS, the world over, were shocked to learn of the death of Kenneth B. Warner, managing secretary of the American Radio Relay League.

KB was a founder of the ARRL. He played a prominent role in the organization of the International Amateur Radio Union in Paris, and represented this country at various other international conferences in Europe. He was scheduled to go to Bogota, Columbia, next spring to attend another radio conference for this country.

THE FOURTEENTH FLOOR of the Bekins Building in Hollywood became quite a hectic scene during the latter part of August, when an advance corps of construction workers, engineers and technicians converged to begin transformation of the floor into studios and offices for KTTV, the Los Angeles TV link of CBS.

When converted, the floor will house a large TV studio with accomodations for three sets, a teleciné studio for film telecasting, master control room, announcer's booth, newsroom, engineering laboratory, carpenter and set shops and set and property storerooms.

The transmitter will be installed atop 5700-foot Mt. Wilson, in a building next to the FM transmitter of KNX, the CBS station in Hollywood. .....L.W.

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Here's an amazing value on Wavemeters which tune from 150-210 mc and contain high quality resonant cavity wavemeter oscillator heterodyne amplifier electric tuning eye complete with 19 tubes, 110 v AC power supply. The tubes alone far exceed the entire price..... **14.95**

RADAR RECEIVER

A "hot" receiver covering the 174 to 210 MC Television band. Has individually slug tuned antenna R.F., Detector and oscillator circuits resulting in maximum sensitivity; contains 2 F.F. and 5 I.F. stages detector and video amplifier. Complete with 110 volt AC power supply and 14 tubes..... **29.95**

TRANSMITTER

BC-1072-A—An outstanding Kayline value.

24.95

DYNAMOTOR

Dynamotor Model 505!

DC input	DC output
volts 27.0	volts 285
amps 1.50	amps .060

75c

OSCILLOSCOPE

MADE BY WESTERN ELECTRIC

Model BC-412, 5" tubes, 115 volts, 60 cycles. Some not complete. While they last only .....

Plus $8.50 crating chg.

24.95

100 PC. CARBON RESISTOR KIT

This kit comprises one hundred all insulated ¼, ½, 1 and 2 watt resistors in the most popular manufactured brands. ALL GUARANTEED TO R.M.A. COLOR CODE.

99c

Only 2 to a customer

HEADSET

These are fine brand new miniature earphones, 8000 ohms, light weight. A special purchase..... **2.49**

METER

This is Type NX33 meter manufactured by Westinghouse. Milliammeter O-300 MA. A super-special Kayline buy!..... **1.95**

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Mobile Station

(*Continued from page 43*)

values, the oscillator was tuned first with the aid of a receiver with accurate calibrations and a sensitive wavemeter. (The popular type wavemeter using crystal diode and 0-1 ma. meter will give good indication on oscillator output voltage.) Starting with the oscillator coil slug clear out, it was gradually turned in until the oscillator frequency reached 25,400 (27,000 minus 1600) kc., with C_1 and C_2 at full capacity. With the tuning condensers set at minimum capacity, the oscillator should now tune to about 28,400 (30,000 minus 1600) kc. If such is not the case, it will be necessary to adjust the oscillator padder slightly and readjust the tuning slug. Of course if a different tuning condenser is used, having different maximum and minimum capacities, it may be impossible to get the same tuning range. A condenser having a range of about 10 $\mu\mu$fd. from minimum to maximum capacity will just cover the 10 and 11 meter bands nicely. The next step was to connect the output of L_3 into a broadcast receiver tuned to 1600 kc., then adjust C_7 for maximum tube hiss. With the converter operating in this manner, the slug in L_1 was adjusted to give maximum signal strength on 10-meter signals. Slight adjustment of the mixer padding condenser might be necessary for different lengths of receiving antennas. Use of a wavemeter in adjusting the oscillator is advised, as otherwise it may be difficult to determine the fundamental frequency of the oscillator. It is also recommended that the transmitting antenna be used for receiving, as more gain is available if the antenna is resonant for the band.

Before construction was begun on the transmitter, the converter was installed in the car and given a workout. The usual ignition, generator, and other noises were encountered and tracked down. Ignition noise was effectively eliminated by installing spark plug suppressors and by incorporating a simple noise limiter in the broadcast receiver. There are a number of circuits available for noise limiting. However, the most practical and simple involve the use of crystal or tube diodes such as the 1N34 or 6H6 in shunt or series-type limiters. In the case of the writer's automobile receiver, a *Chrysler-Philco* radio installed in a 1941 *Plymouth*, the original second detector tube (7B6) was replaced with a 7X7 tube which contains a diode-triode section and an additional diode-cathode section which is being used as a shunt-type limiter. Full a.v.c. voltage is applied to the anode of the limiter through a 1 megohm resistor, while the limiter cathode is tapped down about 20% on the detector diode load resistance. The anode is bypassed to ground by a .05 μfd. condenser. Normally, therefore,

the anode of the limiter is negatively charged with respect to the cathode, thus preventing conduction. However, sharp noise pulses of short duration, such as ignition noise, but of an amplitude sufficient to drive the limiter cathode negative with respect to the anode, are shorted to ground. The high *RC* time constant in the a.v.c. circuit to the limiter anode prevents sharp pulses from changing the a.v.c. bias. This noise limiter works very effectively for the writer, automatically cutting ignition noise down to the level of the received signal, and yet producing no distortion or change of level or audio frequency response of the signal. A 1N34 crystal diode was tried in the same circuit first, but it appeared to have the above-mentioned effects on the signal. The tube limiter works much better in this particular case. The 7X7 can be used to replace the 7B6 with only one or two socket changes and the addition of two resistors and one condenser. If the car radio is equipped with other second detector tubes, it will probably be necessary to change the socket or make other arrangements, such as incorporating an additional tube as a noise limiter. Most car radios are pretty crowded, but there should be room to slip in a miniature 6AL5 diode tube.

Outside of ignition noise, the other most commonly experienced noise originates in the generator. It will probably be found, as it was in the writer's case, that the usual 0.5 μfd. condenser across the output of the generator is ineffective at high frequencies. A very good filter for this type of noise consists of an r.f. tuned filter in series with the output lead of the generator. Specifically, this filter can be constructed as follows: Wind a coil having an inductance of about 1 micronenry. This coil can be made up with 10 turns of heavy wire (No. 10 or larger to carry the generator output current) with a length and diameter of 1 inch. Connect a mica trimmer of the 3-30 μμfd. variety across this coil. This parallel resonant circuit is placed in series with the generator output lead and tuned for maximum rejection of generator whine. If the car body is loose, it may be necessary to bond major panels together with flexible braid. Of course it may be expected that the specific treatment for each individual automobile will be different, therefore no further noise-suppressing discussion will be necessary.

Total cost of the converter was about $10, and this sum represents a considerable saving over factory-built converters, making it well worthwhile constructing your own. The gain of this one-tube circuit is remarkable, and it stacks up very well against converters using 3-tube circuits. In fact, considering the normal amount of noise encountered when operating with the station in motion, the 1-tuber will pull in anything that can be heard on any 10-meter receiver. The operator who likes to park on top of a hill

away from all interference will be pleased with the way he can hear the DX roll in. Due to the intermediate frequency of the converter, no images are encountered.

The second article of this series will cover the transmitter used with this converter to complete a low-cost mobile station. Actual cost of the writer's transmitter was about $25, thus making the total cost of the complete mobile station in the vicinity of $35. The only two major pieces of surplus equipment necessary to make this low cost possible are the transmitter dynamotor and microphone. All other parts are standard.

(To be continued)

Microwave Relays

(Continued from page 38)

and 7000 megacycles. The signal-to-noise power varies between 37.6 and 45.7 db. along the route. It has been found that due to the substantial distances between relay points for the available elevations, some grazing at the horizon takes place during the summer months when trees are in full foliage. This may manifest itself in a less optimum communication path. The transmission from the New York terminus to the first repeater-booster station of the *Philco* portion of the system is as follows:

1. The video input operates the repellers of two Type 2K28 reflex klystron tubes.

2. These tubes are connected to cavities and are tuned 115 megacycles apart when not undergoing change due to modulation. Under modulation they swing apart as much as 125 megacycles. The output of these two 2K28 tubes without modulation is 3235 and 3350 megacycles. The intermediate frequency fed through a crystal comes out at low level. It is boosted through a type 832 and a type 829 i.f. amplifier stage before being fed into a type 2C39 disc seal tube in a cavity. This tube is an r.f. mixer. Feeding into it are a 2C39 heat-compensated oscillator and a 2C39 buffer, each with its own cavity. The high side of the mixed frequency is at 1370 megacycles which is fed to the 4-foot parabolic antenna reflector via a coaxial cable. The antenna gain is approximately 20 db. or 100 times at each station. The receiver is a superheterodyne employing a reflex klystron local oscillator and a crystal converter.

The *General Electric* microwave relay system from New York to Schenectady, N.Y. is a simplified one-way radio network for relaying WNBT Channel 4 program material so that it may be retransmitted at Schenectady to local television receivers. The program is received by direct broadcast on a television receiver atop the *General Electric* building in New York City and fed into the microwave transmitter. The video signals are fed into a three stage preamplifier followed by a 6AG7 amplifier, 6L6 amplifier, 4D32

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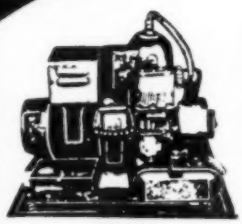

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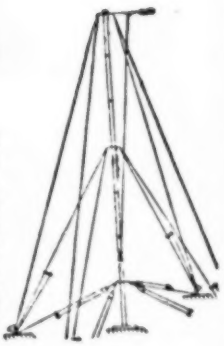

Doublet Antenna Kit used with the famous Hallicrafters BC-610, consisting of 7 steel-alloy mast sections in a handy canvas bag. Each section is 5' 6" long, 1½" OD with the last 6" rolled to a smaller OD to telescope into the end of the preceding section. No taper. Assemble into mast up to 35" high or shorter by any multiple of 5'. Finished in weatherproof olive drab. **Ideal for erection of FM and Television Beams!** Drop your coaxial cable right through the center! Brand new, export packed.

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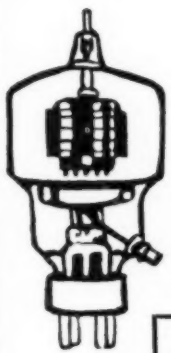

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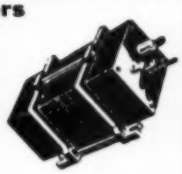

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amplifier, 6SL7 d.c. insertion for the klystron, 1616 final modulator tube and thence modulating the repeller of a type SRL7 reflex klystron in the 2000 megacycle region. The accompanying sound is fed by landline direct to Schenectady. The relay system comprises intermediate repeater-booster points at Beacon, Roundtop, and Heldeberg in New York state.

Fig. 1 shows the new microwave research tower of the *Federal Telecommunication Laboratories* at Nutley, N.J. Mounted on the tower are experimental parabolic reflectors for operation with a variety of microwave communications and relay equipment of their manufacture. For the 900 megacycle region, they employ a 6 foot dish reflector with a gain of 26 db. For 2000 megacycles, they employ a 10 foot dish reflector with a gain of 36 db. At 5000 megacycles, they achieve a gain of 42 db. with the same 10 foot dish reflector. They are employing a type SRL17 klystron on 900 megacycles, a 2C43 disc-seal tube on 2000 megacycles, and a choice of klystrons for higher frequencies. They have specialized particularly in the development of microwave communication and relay equipment employing pulse time modulation principles to provide large numbers of simultaneous communication channels.

Fig. 5 shows the locations and tower elevations for the so-called "New York-Washington-Pittsburgh triangle" of the *Western Union* microwave relay system. The equipment was originally designed and manufactured by the *Radio Corporation of America* with continued production being undertaken by the *Philco Corporation*. The system may accommodate two television relay channels even though primarily intended for up to 270 quadruplex communications channels. The results to date have been sufficiently promising to justify the next stage of expansion towards Chicago.

Fig. 4 shows microwave radio field tests actually underway between Chicago and Milwaukee, Wisconsin. This is a $500,000 program financed by the *Illinois Bell Telephone Company* and the *American Telephone and Telegraph Company's* Long Lines department.

Fig. 6 shows transmitting and metal lens antenna horn equipment used for relaying television from the Hollywood, California studio to the television transmitter located on Mt. Wilson. A landline is used for transmitting the accompanying sound.

Fig. 7 shows experimental transmitting and receiving antennas, with their associated reflector systems for energy concentration, at the New York terminus of the *Raytheon* network. This system extends from Waltham, Massachusetts to New York City. It is still highly experimental and is currently inoperative while undergoing further consideration as to commercial application.

Interesting observations have been

made in the course of microwave experiences to date. Summer conditions are the most erratic. For example, the *Bell System* experiences violent and fast fades at times between midnight and about 3:30 a.m. in summer although this phenomenon was absent during the remainder of the year. Reception is stable for fluctuations up to 20 db. because of suitable a.v.c. provisions.

The cost of microwave stations can be much lower, the bandpass for equivalent booster station distance separations much greater, and the attenuation much less than for coaxial cable. Where microwave relay systems represent little or no economy with respect to coaxial cables, it is only a temporary condition resulting from elaborate expeditures—in some cases for model housing, long paved access roads, the use of only one channel of communications where several could be handled with the same layout, etc. The general expectation is that microwaves will be very much less costly than coaxial cables for the handling of wide-band transmissions as required for television or multichannel communications. The author is indebted to all the organizations listed for their complete cooperation in permitting an inspection and understanding of the facilities described during the summer of 1948. Everyone feels that although microwaves work satisfactorily and are here to stay in ever-expanding application, equipment and tubes for the application are capable of much greater development and improvement. This is constantly taking place in government, industry and among research laboratories. The needs and possibilities exist to the extent that the wherewithal is being made increasingly available.

NOTE: This article is based on a long and continuous survey on the communications and relay aspects of microwaves made on behalf of the microwave component firm of DeMornay Budd Inc. It culminated in a three-week, full-time study of existing systems and applications during the period July 6th to July 23rd inclusive. The author conducted this survey with the cooperation of all of the organizations involved and has compiled this special report for the readers of RADIO & TELEVISION NEWS. —30—

"I lifted a lot of things in my life—But this is the last time I handle hot radios!"

Stop That Pedestrian

(*Continued from page* 67)

and Watch Radar." Upon touching the window (the plate being inside) at that point, a model train starts running and stops upon removal of the hand. Now who doesn't like to watch a toy train run!!! When placed low enough for Junior to operate, Mamma has a deuce of a time removing Junior from the scene. A toy electric train is the most effective object that can be employed.

Many ideas and devices were tried at the *Ideal Radio & Appliance Store,* and as can be seen the variations and combinations of the three basic "crowd stoppers" are numerous and depend solely upon the ingenuity of the store operator.

Other stores, in other trades, may often request rental or sale of your "crowd stopper" equipment. This can be a very profitable sideline as when a capacity relay is used, the operated device (toy train, horn gap, etc.) may be varied weekly to provide a new entertainment for some time.

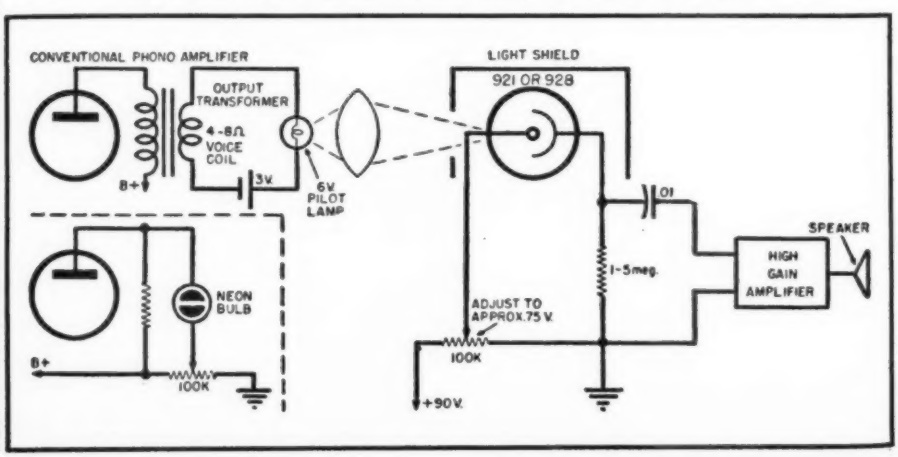
The capacity operated relay shown on the schematic is very simple to build and adjust. It is not the most sensitive type, but it is very inexpensive to build. A 60 volt d.c., 1500 ohm power relay is used in the 0A4 tube plate circuit to directly control 110 volts up to 10 ampere load. The condenser across the relay is to prevent chatter, while the series resistor is to prevent excessive peak current through the 0A4. Radio frequency applied to the 0A4 starter grid keeps the 0A4 tube "fired" and the relay closed. Thus the *NC* contacts (now *NO*) are used to turn on power. This r.f. is supplied by a e.c.o. type oscillator. The grid leak condenser of the oscillator is made variable. A thin wire runs from the grid to the "detector plate." Now the grid leak condenser may be adjusted so that the oscillator is barely oscillating, in which case anybody approaching the detector plate loads up the oscillator enough to cause it to drop out of oscillation. In this particular circuit this causes the 0A4 to extinguish and the relay opening closes the *NC* contacts. Of course the circuit may be modified; the r.f. may be rectified and supplied as negative bias to a power tube thus holding the plate current off until r.f. failure. Practically no power supply filtering is necessary. The coil used may be a standard broadcast r.f. coil, in which case *no* tank condenser is used. This is done in order to place the oscillation at a high frequency, above the broadcast band so as to not interfere with local reception and broadcast receiver demonstration. Needless to say the r.f. radiation should be well below FCC requirements. With flea power at 1500-30,000 kc. it is not too bad.

Sound equipment may be used in conjunction with a capacity relay. Where it is not practical to have the light beam (of a sound-over-light) go out through the window, a capacity relay operating a fan or paddle may be used to break up the audio.

Sound over a light beam requires very little equipment. A standard automatic phonograph is connected, as shown in the diagram of Fig. 3, voice coil-to-lamp. At the photocell end a good amplifier will be required. This can be a small phono-amplifier whose output is fed into the phono attachment on a large receiver. *It* is important that the voltage on the photocell be adjusted close to the correct point. Excess in either direction will cause loss of gain. Excessive high voltage will cause a gas filled tube to ionize and can damage it severely. Care must be taken to keep sunlight, tungsten, or fluorescent light out of the photocell. A hood is recommended. A 120 cycle hum due to stray tungsten or fluorescent light falling on the photocell may be reduced by lowering the first few coupling condensers in the amplifier to .00005 to .0001 values so as to attenuate the low frequency response of the amplifier. The light beam required for this system is small for a ten foot throw, any ¼ to ½ watt neon or any 6-8 volt pilot light is satisfactory for the light source.

This article can but point the way to "Stop That Pedestrian," you, the reader, can employ variations to fit the times and *your* store. —30—

Fig. 3. Setup used to produce "sound on a light beam" effect.



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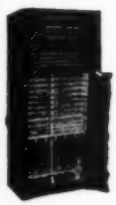


CONSOLE PANEL SB-19/GT

Supervisor-operator panel: consists of jack and key panels, relays, and line terminating facilities. Used originally to monitor and patch up telephone lines in plotting shelter, and to switch outside telephone lines. Size: 60" x 28" x 18". New, export packed $350.00

EE-89A REPEATER

Extends range of field telephone apparatus, such as EE-8 up to 25 miles, when inserted in a line. New with spare tube and instruction manual, less standard type batteries $21.50

BC 686 LINE AMPLIFIER

With magneto ringer, 3-tube 25L6 amplifier. For local point-to-point telephone operation, remote operation of Phone Xmtr, remove reception of receiver output, monitoring facility. Requires only 24VDC for Tube B plus for full operation. New, less tubes, in wooden chest.$18.50
Per pair for 2-way pt-to-pt operation.....$35.00

FEDERAL F.T.&R 101-A TWO WIRE APPLIQUE

Provides necessary balancing facilities for four-wire repeater when used on two-wire lines which may be voice-frequency telephone lines of open wire, or non-loaded or loaded cable. Std. 19" channel iron rack mtg. Price, new, complete with tech. manual.....$54.00

GREAT TUBE VALUES

01-A	$ .45	5J30	$39.50	530	$90.00	1624	$ .85
1B24	4.85	6AC7	1.00	531	45.00	1629	.35
1H5	.55	6AK5	.95	532	3.95	1961	5.00
1N5	.69	6C4	.38	559	4.00	8012	3.95
1T4	.69	6G	2.00	562	90.00	9002	.65
2C21	.69	6J6	1.00	615	.89	9004	.47
2C22	.69	6K7	.55	703-A	7.00	9006	.47
2J21-A	25.00	6L6GA	1.00	704-A	.75	CEQ 72	1.95
2J22	15.00	6SC7	.70	705-A	2.85	EF 50	.79
2J26	15.00	6SL7	1.00	*707-B	20.00	E-1148	.75
2J27	15.00	6V6	.79	714AY	15.00	F-127	20.00
2J31	25.00	7C4	1.00	715-B	12.00	FC 258A	
2J32	15.00	7E5	1.00	720BY	50.00		165.00
2J38	25.00	7E6	.72	720CY	50.00	FC 271	40.00
2J39	25.00	10Y	.60	721-A	3.60	GL 562	75.00
2J55	25.00	12A6	.35	723-A/B		GL 623	75.00
3J31	$5.00	12GP7	14.95		12.50	GL 697	75.00
2X2/879	.69	12K8Y	.65	724B	1.75	ML 100	60.00
3A4	.65	12SF7	.49	724-D	2.50	QK 59	55.00
3BP1	2.25	12SR7	.72	725-A	25.00	QK 60	55.00
3C24	.60	15R	1.40	726-A	15.00	QK 61	55.00
3C30	.70	28D7	.75	860	2.25	QK 62	55.00
3D6	.79	30 (Spec.)	.70	801-A	1.40	*RCA 932	.65
3CP1/S1	3.50	35L6	.69	804	9.95	VR 91	1.00
3D21-A	1.50	35Z5	.66	815	2.50	VR 130	1.25
3DP1	2.25	45 (Spec.)	.59	836	1.15	VR 135	1.25
3EP1	2.95	50L6	.79	837	1.95	VR 137	1.25
3FP7	1.20	39/44	.49	843	.59	VR 150-30	95
3GP1	3.50	35/51	.72	860	15.00	VU 120	1.00
3Q5	.79	211	.75	861	40.00	VU 134	1.00
5BP1	1.20	227A	3.85	874	1.95	WL 532	4.75
5BP4	4.95	225	8.80	876	4.95	WN 150	3.00
5CP1	3.75	268-A	20.00	1005	.35	WT 260	5.00
5FP7	3.50	355-A	19.50	1613	.85	†with cavity	
5JP2	8.00	417A	22.50	1619	.21		5.00

*Photocell

COAX CABLE

RG 18/U, 52 ohm imp. armored.....$0.51/ft.
EG 24/U, twin coax, 125 ohm imp. armored.....50/ft.
RG 28/U, 50 ohm imp. pulse cable. Corona min. starting voltage, 17 KV.....$0.50/ft.
RG 35/U, 70 ohm, imp. armored.....50/ft.

COAX CONNECTORS

83IR	$0.35	UG 21/U	$0.85
83ISP	.35	UG 86/U	.95
83IAP	.35	UG 254/U	.75
83IHP	.15	UG 255/U	.85

Homedeli male to type "N" male adapter..... 1.25
RT ANGLE Sperry fittings..... 1.00

BAND PASS FILTER

#70473. Sharp band pass peaked at 700 cps. Bandwidth: 650 cycles at 20 db. Down from peak. High-to-high impedance. Can be plugged into 'phone output of receiver for good results. Cuts out QRM New, with circuit diagram $2.25

VOLTAGE REGULATORS

Mfg. Raytheon: Navy CRP-301407: Pri: 92-138 v, 15 amps, 57 to 63 cy, 1 phase. Sec: 115 v, 7.15 amp, .82 KVA, 96-PF. Contains the following components:

Regulator Transformer: Raytheon UX-9545. Pri: 92-138 v, 60 cy, 1 PH. Sec: 200/580 v, 5.5/5.26 amps, 4000 v rms test. Filter Reactor: .156 hy, 5 amps, 4000 v test, Raytheon UX 9547.

Transformer: Pri: 186 v, 5 amps; Sec: 115 v, 7.2 amps. Size: 12" x 20" x 29". Net wt. approx. 250 lbs. Entire unit is enclosed in grey metal cabinet with mounting facilities. New, as shown.....$99.50

TRANSFORMERS

W.E. #KS 9668: Pri: 115 v, 60 cy, 18 amp. Sec: 2750/2470/2240 v, 750 ma. NCT. 7 KV insulation..$34.50
STEP DOWN TRANSFORMER: Pri: 440/220/110 volts a.c. 60 cycles, 3 KVA. Sec. 115 v. 2500 volt insulation. Size 12"x12"x7".....$10.00
PLATE TRANSFORMER: Pri: 117 v, 60 cy. Sec. 17,000 v, @ 144 ma, with choke. Oil immersed. Size 26"x 20"x13". Amertran $65.00
Fil. Transformer: Pri: 220 v.a.c., 60 cy; .05 KVA. Sec. 5 v.c.t., 34,000 v. test.....$24.50
Fil. Trans. UX-6899. Pri: 115 v, 60 cy. Sec: Two 5 v, 5.5 Amp. Wdes, 29KV test.....$24.50
Plate Transformer: Pri: 115/230 v.a.c., 50-60 cy. Sec: 21,000 v, 100 ma.....$120.00

OIL CONDENSERS

.1 mfd. 10 KVDC GEPYR #14F191	$15.00
.06 mfd. 15 KVDC, GEPYR 25F585-G2	8.70
1.5 mfd. 6000 vdc Aerovox	12.50
.25 mfd. 20,000 vdc	17.50
10 mfd. 1000 VDC	1.79
3x10 mfd. delta connected synchro-capacitor, 90 v, 60 cycles, GE	4.95
1 mfd. 6000 vdc, GEPYR 25F509G2	3.85

POWER CHOKES

Swing. Choke: 4.5 to .8 hy; .2 to 1 amp.	$10.95	.116 hy, .15 amp.	$ 4.50
.03 hy, 2 amp.	1.45	.01 hy, 2.5 amp.	1.50
8.5 hy, 125 ma.	1.50	.35 hy, .35 amp.	7.50
25 hy, 65 ma.	1.10	Dual 2.5 hy, 130 ma.	1.25
6 hy, 150 ma.	1.50	.1 hy, 12 amp, 46 ohms	16.00
Dual 7 hy, 75 ma, 11 hy, 60 ma.	1.65	Dual .5 hy, 380 ma.	.95
Dual 2 hy, 100 ma.	.75	5 hy, 40 ma, 312 ohms.	.65
		2 hy, 200 ma.	.75
		Dual 120 hy, 17 ma.	2.45

11.5 KVA TRANSTATS (AMERTRAN)

Input: 0-115 v, 50-60 cycle. Maximum output: 115 v, 100 amp. All units are new, guaranteed.....$75.00 Each

400 CYCLE TRANSFORMERS

Pri: 115 v, 400 cy. Sec: 6.3 v, 2.7 amp; 6.3 v, .66 amp; 6.3 v, 21 amp.....$2.95
32332: Pri: 115 v, 400-2400 cy. Sec: 400 vct, 35 ma; 6.4 v, 2.5 amp; 6.4 v, .15 amp.....$2.25
352-7179: Pri: 115 v, 400-2400 cy. Sec: 6.5 v, 12 amp ct; 250 v, 100 ma; 5 v, 2 amp.....$3.50
#9069: Pri: 115/80 v, 400-2600 cy. Sec: 650 vct, 50 ma; 6.3 vct, 2 amp; 5 vct, 2 amp.....$2.15
352-7096: Pri: 115/80 v, 400-2400 cy. Sec: 2.5 v, 1.75 amp, 3KV ins; 5 v, 3 amp; 6.5 v, 6.5 amp; 6.5 v, 1.2 amp $3.95
KS 9607: Pri: 115 v, 400-2400 cy. Sec: 734 vct, 177 ma, 1710 vct, 177 ma.....$5.95
D-166333: Pri: 115 v, 400-2400 cy. Sec: 6.3 v, 0.9 amp, 7.7 v, 0.365 amp.....$2.79
GE #7471957: Pri: 100/110/120/130 v, 400-2400 cy. Sec: 2.5 v, 20 amp, HV ins.....$4.85
D-163254: Pri: 115 v, 400 cy. Sec: 6.3 v, 12 amp; 6.3 v, 2 amp; 6.3 v, 1 amp. P/O AN/APQ-5.....$5.85
KS 9685: Pri: 115 v, 400-2400 cy. Sec: 6.4 vct, 7.5 amp; 6.4 v, 3.8 amp; 6.4 v, 2.5 amp.....$4.35
PLATE XFMR: Pri: 115 v, 400 cy. Sec: 9800 v or 8600 v @ 32 ma dc.....$12.50
#12033, Plate Xfmr: Pri: 115 v, 800 cy. Sec: 4550 vct, 250 ma.....$7.50
KS 9445, Pwr Xfmr. Pri: 115 v, 400-2400 cy. Sec: 5.2 vct, 120 ma, 6.3 v, 8 amp; 5 v, 2 amp.....$3.50
PLATE XFMR: Pri: 115 v, 400-2400 cy. Sec: 4500 v, 6 ma.....$6.50
#7143. Pri: 115 v, 400 cy. Sec: 6.3 v, 7 amp, 8.3 v, 8.8 amp; 6.3 v, 1.3 amp.....$2.50
FIL XFMR: Pri: 115 v, 400 cy. Sec: 6.3 v, 9 amp; 6.3 vct, .65 amp; 2.5 v, 3.5 amp; 2.5 v, 3.5 amp.....$3.25
KS 9584. Pri: 115 v, 400 cy. Sec: 5,000 v, 200 ma; 5 v, 10 amp; size: 7"x10"x6".....$15.00
Pri: 115 v, 380-2800 cps. Sec: 2200 v, 350-VA, open frame.....$3.95
PLATE XFMR: Pri: 115 v, 400 cy. Sec: 1150-0-1150 v, 40 ma. GE, 68G631.....$1.75

INVERTERS

PE 206-A: Input: 28 VDC @ 38 amp, Output: 80 volts @ 500 volt-amps, 800 cycles, Leland. New, complete with enclosed relay, filter, instruction book.....$12.50
PE 218: Input: 25-28 VDC @ 92 amps. Output: 115 volts @ 1500 volt-amps, 380-500 cycles. Used: $15.00 New: $45.00.

XMTR TUNING UNITS

From BC 375: TU-9 (7.7-10 mc); TU-10 (10-12.5 mc); Tu-22 (350-650 kc); TU-26 (200-500 kc). Each $2.75
For BC 610; TU 48 (2.5-3 mc); TU 47 (2-2.5 mc); TU 53 (8-12 mc). Each.....$1.75
For BC 223AX: TU 17 (2-3 mc); TU 18 (3-4.5 mc). Each $1.95

30' U.S. ARMY SIGNAL CORPS RADIO MASTS

Complete set for the erection of a full 3at top antenna. Of rugged plymold construction telescoping into 3 ten-foot sections for easy stowage and transportation. A perfect set-up for getting out. Supplied complete: 2 complete masts, hardware, shipping crate. Shipping wt. approx. 300 lbs. Sig Corps #2A289-223-A. New.....$39.50 per set of 2

MAGNETRONS

TUBE	FRQ. RANGE PK.	PWR. OUT.	PRICE
2J31	2820-2860 mc.	265 KW.	$15.00
2J21-A	9345-9405 mc.	50 KW.	25.00
2J22	3267-3333 mc.	265 KW.	15.00
2J26	2992-3019 mc.	275 KW.	15.00
2J27	2965-2992 mc.	275 KW.	15.00
2J32	2780-2820 mc.	285 KW.	15.00
2J38 Pkg.	3249-3263 mc.	5 KW.	25.00
2J39 Pkg.	3267-3333 mc.	4.7 KW.	25.00
2J55 Pkg.	9345-9405 mc.	50 KW.	25.00
3J31	24,000 mc.	50 KW.	55.00
5J30			39.50
T14AY			15.00
T20HY	2800 mc.	1000 KW.	50.00
T20CY			50.00
725-A			25.00
730-A			25.00

Klystrons: 723A/B $12.50
707B (w/cav.) 20.00
726-A 15.00

MAGNETS

For 2J21, 725-A, 2J22, 2J26, 2J27, 2J31, 2J32 and 3J31 .....Each $8.00
4850 Gauss, ⅝" bet. pole faces, ⅝" pole diam..... 8.00
1500 Gauss, 1½" bet. pole faces, 1⅝" pole diam.... 8.00

TUNABLE PKG'D "CW" MAGNETRONS

QK61.....2975-3200 Mcs QK62.....3150-3375 Mcs
QK60.....2800-3025 Mcs QK59.....2675-2900 Mcs
New.....$35 each

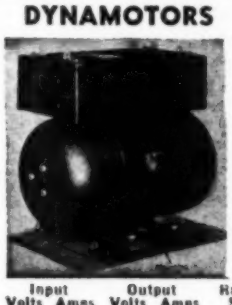
VARISTORS—W. E.

D-171121	$0.95	D-168549	$0.95
D-171031	.95	D-162482	3.00
D-167176	.95	D-99136	1.65
D-170225	.95	D-166271	2.50
D-168687	.95	D-162356	1.50
D-171812	.95	D-16187A	2.85
D-171528	.95	D-99946	2.00
D-163298	.95		

THERMISTORS—W. E., $.95 Ea.

D-167332 (bead) D-166228 (button)
D-170396 (bead) D-167018 (tube)
D-167618 (button)

DYNAMOTRONS



Type	Input Volts	Input Amps	Output Volts	Output Amps	Radio Set	Price
PE 73	28	19	1000	.350	BC 375	$24.50N
BD 77KM	14	40	1000	.350	BC 191	20.00N
						14.00LN
DM 21	14	3.3	235	.090	BC 312	3.45LN
DM 21CX	28	1.6	235	.090	BC 312	3.45N
DM 25	12	2.3	250	.050	BC 367	2.49LN
DM 28R	28	1.25	275	.070	BC 348	8.75N
DM 33	28	7	540	.250	BC 456	5.50N
DM 42	14	46	515	.110	SCR 506	6.50LN
			1030	.050		
			2/8			
PE 55	12	25	500	.400	SCR 245	5.25LN
PE 86	28	1.25	250	.060	RC 36	3.95N
PE 101 C	12/26	12.6/ 6.3	400 800	.135 .020	SCR 515	5.25N
		9	AC	1.12		
BD AR 93	28	3.25	375	.150		4.95N
23350	27	1.75	285	.075	APN-1	3.50N
35X045B	28	1.2	250	.060		3.50N
ZA .0515	12/24	4/2	500	.050		3.95N
B-19 pack	12	9.4	275 500	.110 .050	Mark II	9.95N

*N—New. LN—Like New.
SELSYNS—115 v, 60 cy. Size 5.....$7.75 pr.

INSTRUCTION MANUALS

BC 312, BC 342	$1.25		
SCR 281	$1.25	Mark II	1.00
ZA Eqpt.	1.00	SCR 508	1.00
BC 642	1.00	SX 32	1.00

VIBRATORS

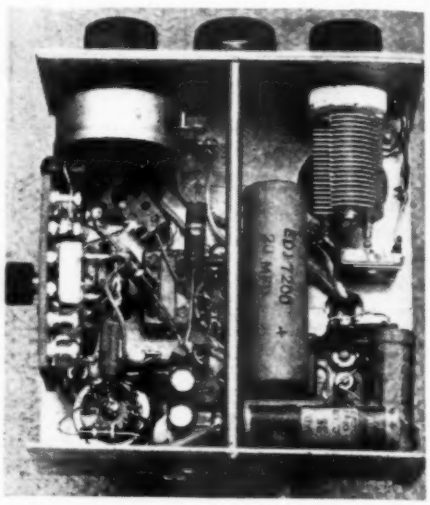
TR 1210, 12 vdc, 5 pin.....$1.20
OAK V-6675, 24-32 vdc, 7 pin..... 1.10
Mal. Type G534C, 12 vdc, 5 pin..... 1.25
Mal. Type G629-C, 12 vdc, 4 pin..... 1.15
Radiaart VR2, 6 v, DC, 6-pin special..... 1.40
Mfrs. quantities in all types available.

Compact Superhet

(*Continued from page* 53)

together or spread apart on the form until the proper frequency range is covered and then a heavy coat of coil dope applied to the coil.

On the rear apron of the chassis an insulated jack is mounted for the headphones and a grommeted hole is provided for the power supply cable. The receiver is Scotch on power consumption; a one amp. filament transformer will supply the heaters with power to spare and any plate voltage from 22½ to 150 volts may be used. At 22½ volts the receiver draws but 3 ma. and at 150 volts the current is 14 ma. At this drain a "B" battery will give almost shelf life. There is not a great deal of increase in headphone volume with the higher plate voltages and the use of voltages over 67½ or 90 volts is hardly justified.



Under chassis view of compact receiver. The b.f.o. pitch control condenser is mounted on a small bakelite terminal strip. The brace under chassis is length of brass tubing tapped at each end to carry machine screw.

—30—

"The name of the selection now playing is . . . . !"

Recording of Sound
(Continued from page 50)

can normally be taken from the power supply of the original equipment.

Figs. 2 thru 13 illustrate the various typical curves obtained with this equalizer with the setting at maximum value.

To permit equalization for a wide variety of applications, the high frequency and low frequency boost sections are arranged for two frequencies each. In most applications the frequency desired is predetermined, and when the unit is wired into the equipment, the appropriate connections are employed. If a wide range of use is anticipated, the 50 cycle and 100 cycle

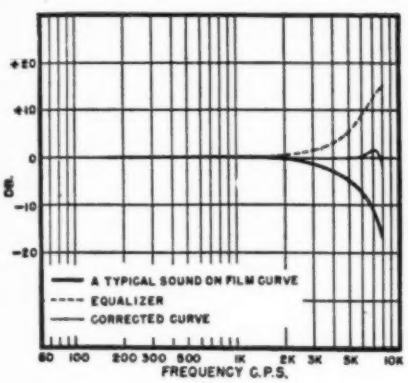


Fig. 9

terminals can be brought out to a single-pole, double-throw switch, and in like maner, the 5 kc. terminals to a similar switch, thus permitting instantaneous changeover to the desired resonant frequency.

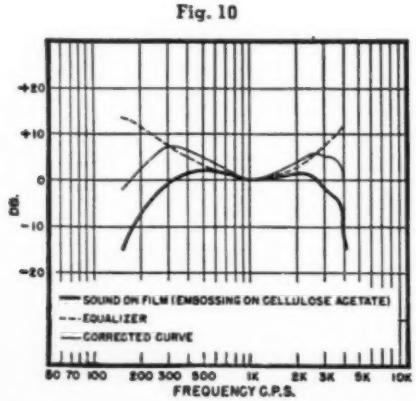
The following considerations should be observed in order to take full advantage of the possibilities of the equalizer:

1. The unit is designed to work between two impedances of 10,000 ohms, and this value of termination must be used to maintain accuracy of calibration.

2. No distortion is introduced if the maximum level at the equalizer input is held below 2 volts, with negligible distortion at several times this value. The unit should not be used at signal levels above 10 volts.

3. When adding this type of reso-

Fig. 10



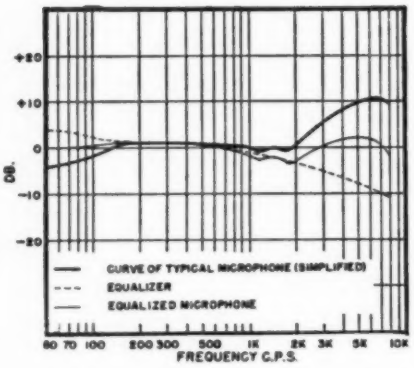


Fig 11.

nant equalizer to an amplifier with very little reserve voltage gain, a preamplifier such as cascaded triodes will result in an output voltage essentially equal to the input voltage when both maximum bass and treble boost are used.

4. When an amplifier incorporating the CGE-1 is run with no boost, the mid-frequency gain is 30 decibels over that with full boost. For best signal-to-noise ratio under these conditions,

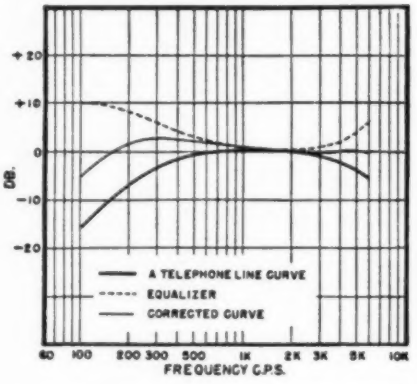


Fig. 12.

a master gain control should be used in the circuit after the equalizer itself.

Another popular commercial tone control system developed by *Thordarson* engineers is employed in the record-reproduce amplifier (Part 11, of

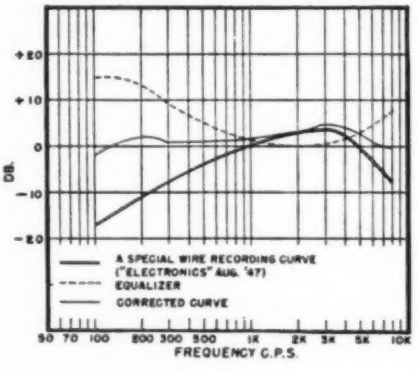


Fig. 13.

this series). It is based on the degeneration in the cathode circuit of a suitable triode amplifier.

REFERENCE:

United Transformer Corp., Bulletin CGE.

(To be continued)

Ladder-Type Mast

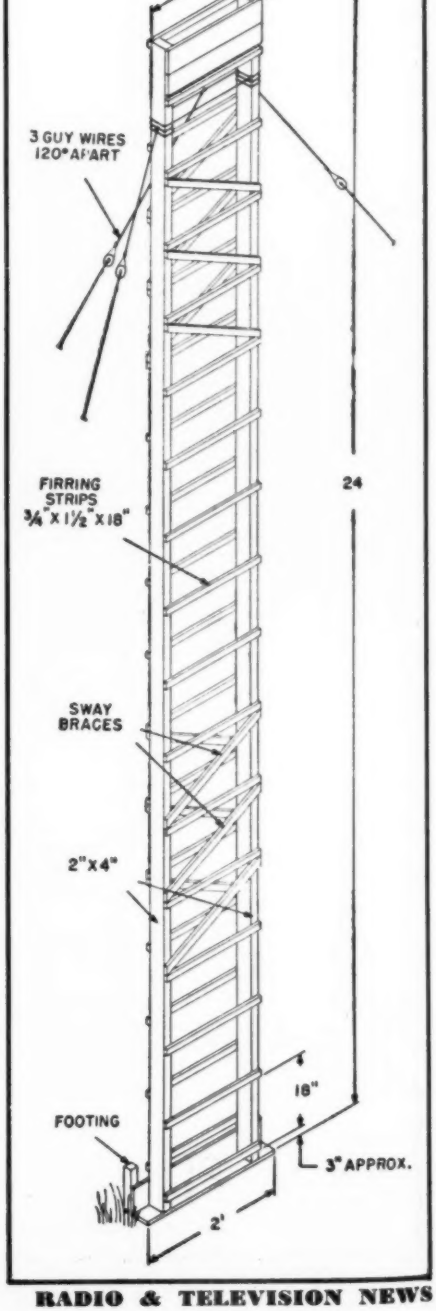
(*Continued from page* 57)

and securely, at which point the ladder mast now became entirely self-supporting.

However, to further secure the base, additional 2½ foot stakes of firring strip were driven at the base of the mast and several turns of guy wire fastened at this point to bind the footing and prevent the ladder mast from walking.

With the mast in position, the next problem was one of getting the two element 20 meter beam in place. This was accomplished by the use of an

Construction details for building mast. The entire unit was built in a few hours using just standard household hammer and saw.



extension ladder since the length of a twenty meter beam presented an awkward problem.

It is not intended to describe the beam in use here inasmuch as there is a quantity of information available on this subject.

However, it has been demonstrated that this mast can carry the weight of three men at one time, since at one point in the beam raising, an element snagged a guy wire and required the assistance of the two neighbors to climb the mast on either side and free the element; this, with the author at the top of the mast.

We are looking forward with no hesitancy to placing an electrically driven rotator and 3 element 20 meter beam at the top of this structure.

The height of this ladder mast has proven entirely satisfactory for twenty meter operation and should prove an excellent height for ten meter operation.

It was also our intention to describe this ladder mast so it may take a place in the thought of amateurs, along with the other types when considering the construction of a mast or tower for a beam or plain skywire.

—30—

Mac's Service Shop
(*Continued from page* 58)

appear between this point and *A* and this point and *C*. By sliding the little clip of our one-string fiddle up and down the resistance wire, I can reach a point where the meter will show exactly equal voltages across the resistor and across the voice-coil."

"That means that the impedance of the resistor is the same as that of the voice-coil, huh?"

"Right; and while the impedance of the voice-coil is made up of its d.c. resistance *and* its a.c. inductance, the impedance of our resistor is practically that of its d.c. resistance alone, for a straight wire like this has negligible inductance at 400 cycles."

"So all we have to do is to measure the resistance with an ohmmeter, and we know the impedance of our voice-coil," Barney said; "but why did you use the vacuum-tube voltmeter? Wouldn't the multimeter have worked just as well?"

"Yes, for we are not interested in absolute values. All we need to know is that the two voltages are equal. I use the vacuum-tube voltmeter through force of habit when measuring an a.c. voltage other than 60 cycles. Copper oxide rectifier meters are quite frequency-conscious, and they are calibrated at 60 cycles; so they are not too reliable at other frequencies."

"You use this special kind of rheostat in order to get away from the inductance you would find in an ordinary spiral-wound job. That I get; but wouldn't the impedance of the voice-coil change if you used some frequency other than 400 cycles?"

"It would, but unless stated otherwise, all audio equipment impedances are given for 400 cycles. Your matching chart for the output transformer is worked out for 400 cycles."

While Mac watched, Barney turned on the receiver and carried out the procedure outlined. It was found that the voice-coil impedance was very near six ohms; so the proper taps were connected.

"Say, Mac," Barney suddenly said, "I have to give a little talk tonight at the Y. Each of us is supposed to talk on 'What Makes a Good ———'; and we fill in the blank with what we want to be. I want to be a serviceman; so how's about giving me some pointers?"

Mac rubbed his chin for a few seconds, and then he said slowly, "I think that the ability to play the game of 'Twenty Questions' is what it takes to make a good serviceman."

"Come again," Barney said in bewilderment.

"You know the game. One person thinks of an object, and the idea is to identify it by asking not more than twenty questions. The cleverest person is the one who can name the object with the fewest questions.

"Radio servicing is like that. Instead of an unknown object, you have an unknown trouble to find. You ask yourself the questions, and you make tests to find the answers. The good serviceman is the one who can spot the difficulty with the fewest number of tests.

"You will remember that the classical first question in the game of 'Twenty Questions' is: 'Is it animal, vegetable, or mineral?' That is a fine question, for it immediately cuts down the field to be investigated by two-thirds. The serviceman who puts an audio signal into the first audio stage of a 'dead' receiver and hears it coming out of the speaker has done about the same thing, for he knows that the trouble is ahead of this point.

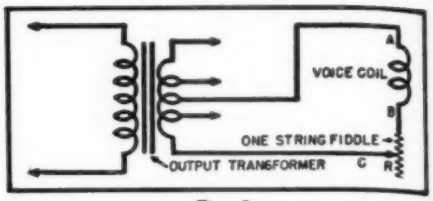


Fig. 2

"The main idea is not to ask unimportant questions that waste time. For example, instead of finding out what kingdom the object was in, a foolish person might ask, 'Does it wear a hat?' The answer would be 'no' whether the object was a turnip, a lump of coal, or a red-headed radio apprentice, and that question would be wasted. The fellow who simply prods around in a set checking condensers, resistors, voltages, etc., without any plan or purpose is playing the game in the same stupid manner. I am more impressed by the head-scratching, diagram-studying serviceman than I am by the fellow who thinks he is not working unless he has a pair of test-prods in hands."

Barney, who had been scratching down notes on a torn-open volume control box, looked up with a grin. "Thanks a lot, and I'm after thinking 'tis a fine speech you are going to be making with my mouth this evening, Mr. McGregor," he said; "and I hope you'll be remembering after this that when you catch me staring off into space, I am not thinking about Margie; I am simply playing 'Twenty Questions'!"

—30—

LOCATING METER SCALE DIVISIONS

BY GEORGE A. BURNS

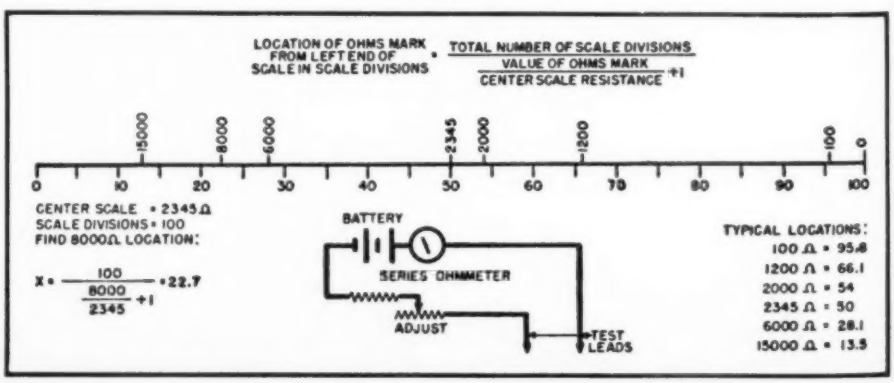
WHILE experimenting with several different meters and values of center scale resistance in a series ohmmeter circuit I had occasion to draw several accurate scales to expedite checking the complete meter.

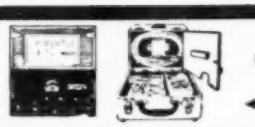
I soon discovered that I was spending more time calculating values for the scale than I had spent on the design of the electrical circuit. After wading through several formulas, all of which seemed to be rather complicated, I determined to find a simple method for locating the "ohms marks," using the most basic information possible.

For example: Given a series ohmmeter with a total internal resistance of 2345 ohms and a linear scale of fifty divisions. The problem is to find the location of 100, 2000, 2500, and 15,000 ohm divisions on the ohmmeter scale.

To solve this problem use the formula given in Fig. 1 worked out for 100 scale divisions. —30—

Fig. 1





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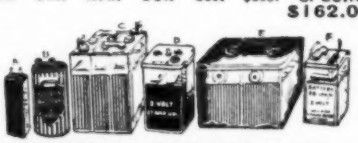

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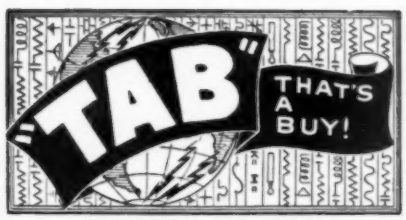

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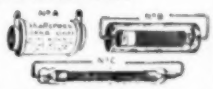

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15	370	1322	5100	25000
16	375	1350	5200	25200
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48	427	1646	6200	33000
50	440	1650	6300	35000
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55	452	1680	6500	38140
60	470	1710	6840	38500
63	475	1740	6990	39500
68	478	1770	7000	40000
71.4	480	1800	7500	43000
74	487	1818	7700	47000
75	500	1830	7930	48000
80	520	1865	8000	48660
81.4	525	1900	8250	49000
89.8	540	1910	8500	50000
90	550	1960	8700	52000
95	575	2000	8992	54000
100	580	2045	9000	56000
101	600	2080	9445	60000
105	607	2095	9500	61430
105.7	612	2145	9710	62000
107	625	2160	10000	64000
113.1	633	2195	10430	65000
120	640	2200	10500	68000
121.2	641	2250	10600	70000
125	649	2300	11000	72000
147.5	650	2400	11400	75000
150	657	2450	11500	80000
160	665	2463	11690	84000
165	669	2485	12000	90000
170	670	2490	12600	91000
175	675	2500	13220	95000

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125000	185000	268000	422000	654000
130000	201000	275000	458000	750000
135000	220000	294000	478000	761300
140000	225000	307500	500000	800000
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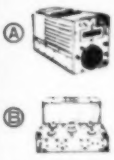

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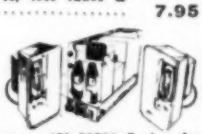

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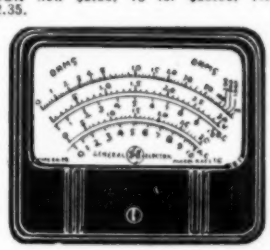

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Distortion Meter

(*Continued from page 69*)

tortion, thereby removing the need to make a special meter scale or conversion chart. This meter circuit affords a good degree of linearity. Any departure from linearity, due to individual crystal characteristics, has been found by test to affect the accuracy of the instrument only slightly. Increased accuracy may be obtained by switching in lower resistance multipliers for closer reading of the meter at null. The addition of these multipliers is discussed in detail under "Meter Switching for Increased Accuracy." It is not possible to employ a less expensive 0-1 milliammeter, since the internal resistance of that instrument is too low for this application.

The choke coil, CH_1, is an important part of the circuit. For satisfactory results, this component must have the proper ratio of reactance to resistance. A number of chokes were tested in the circuit during the development of the instrument, and the reader is cautioned to use the particular one specified in Fig. 4A.

The input jack, J_1, allows easy disconnection of the input leads. The 2-lead, flexible input cable, seen attached in Fig. 1, has clips on one end for connection to the loudspeaker voice coil and a plug on the other end for insertion into jack J_1.

The distortion meter is built in a 10½" x 7¼" x 6" metal cabinet. This is a standard radio box. No chassis is employed, all components being fastened to the front panel. Fig. 5 shows arrangement of the components behind the panel.

The input gain control (R_1) and changeover switch (S_1) are accessible from the front of the panel. Rheostat

Table 1. Calibration data for new meter ranges. This data is only typical, having been taken with a sample crystal. Individual calibration will be necessary.

METER SWITCH IN 10% POSITION		
R.M.S. Volts Input	Micro-Amperes	% Dist.
1.0	100	10
.9	82	9
.8	71	8
.7	62	7
.6	50	6
.5	40	5
.4	32	4
.3	23	3
.2	16	2
.1	6	1
0	0	0

METER SWITCH IN 5% POSITION		
R.M.S. Volts Input	Micro-Amperes	% Dist.
0.5	100	5
.4	78	4
.3	56	3
.2	38	2
.1	20	1
0	0	0

R_2 is mounted on a bracket behind the panel, however, and provided with a slotted shaft for screwdriver adjustment, since this component needs no readjustment after it once has been set during the initial calibration of the instrument.

The low resistance value of the input gain control, R_1, has been chosen for minimum interaction with the crystal rectifier operation. Since most of the serviceman's distortion measurements will be made across low impedance voice coils, and at the relatively low impedance output of audio oscillators, we believe this low input resistance will not be detrimental.

Wiring is simple and straightforward. It is advisable to run all leads as straight and direct as possible. Shielding of leads is not required. In the meter circuit, the correct polarities of both meter and crystal (as shown in Fig. 4A) *must* be observed. Also, resistor R_3 must be placed *ahead* of the crystal, as shown in the schematic. If the reader accidentally wires the crystal backwards into the circuit, he must not reverse the meter connections to obtain up-scale deflection, since this arrangement will measure *negative* half-cycles. If this mistake is made, rewire the crystal correctly.

Initial Adjustment

1. Connect input jack of distortion meter to output terminals of variable-frequency audio oscillator.

2. Set output control of oscillator to maximum.

3. Throw switch S_1 to *"SET."*

4. Set oscillator frequency dial to 400 cycles.

5. Adjust gain control R_1 for full-scale deflection of microammeter.

6. Throw switch S_1 to *"READ,"* noting drop in meter deflection.

7. Tune oscillator dial above and below 400 cycles, noting that meter deflection passes down through very low value (null) and up again. Retune oscillator dial carefully for lowest "dip" in microammeter reading. This setting of oscillator dial should be 400 cycles. If it is not, due to inaccuracies in condensers C_1 and C_2, mark exact point on oscillator dial for quick retuning in future to distortion meter frequency.

8. Adjust rheostat R_2 carefully for still lower reading of microammeter at null. The improved null point will be found very definitely in adjustment of the rheostat. Beyond the null setting of R_2, the meter reading again will rise.

9. When the best null point is obtained, the meter very likely will not read exactly zero. The reading at this point is the distortion percentage of the audio oscillator. This figure must be recorded, since it should be taken into consideration whenever the oscillator is used subsequently in distortion measurements.

After these adjustments are completed, the distortion meter will be ready for use. When making distor-

tion measurements, the audio oscillator always must be set exactly to the null frequency of the distortion meter. This may be done either by setting the oscillator frequency dial exactly to the point marked in Step 7 or by tuning for minimum dip in meter reading with switch S_1 thrown to its *"SET"* position.

Using the Meter

A. Measuring Amplifier Distortion

1. Connect input terminals of distortion meter to voice coil of loudspeaker. If test must be noiseless, replace speaker voice coil temporarily with resistor having same ohmic resistance as voice coil impedance value, and rated at twice wattage of amplifier output.

2. Connect audio oscillator to amplifier input terminals.

3. Throw switch S_1 to *"SET."*

4. Advance amplifier gain control to maximum, or to the point at which it is desired to check distortion.

5. Advance oscillator output control slightly.

6. Advance distortion meter gain control (R_1) for full-scale deflection of meter. Advance oscillator output control further, if necessary.

7. Throw switch S_1 to *"READ,"* and read distortion percentage directly from meter scale. Before recording this figure, make certain that oscillator frequency is correct—retune dial carefully for lowest null. From distortion figure obtained from meter, subtract oscillator distortion percentage previously obtained in Step 9 under *"Initial Adjustment."*

8. Separate distortion measurements may be made at different settings of the amplifier gain control or at various levels of amplifier input signal voltage. In each instance, first set meter to full scale (by means of R_1) with switch S_1 in *"SET"* position. Distortion readings will be helpful in checking the effect of altering the value of load resistors, coupling condensers, and changing tubes and voltages within the amplifier under test.

B. Measuring Distortion of Audio Oscillator

1. Connect audio oscillator output terminals directly to distortion meter input terminals.

2. Set oscillator frequency dial to 400 cycles.

3. Set switch S_1 to *"SET."*

4. Advance oscillator output control to maximum.

5. Set meter to full-scale by means of gain control R_1.

6. Throw switch S_1 to *"READ,"* noting drop in meter reading. Adjust

Table 2. Total distortion percentages for output tubes operated at maximum power output. It may be assumed that they are operating as single-ended Class A_1 except where noted otherwise.

1A5GT	7.0
1C5GT	10
1D8GT	(pentode section) 10
1E7G	p. p. class A_1 5.5
1F4	p. p. class AB_1 4.5
1F5G	p. p. class AB_1 4.5
1G5G	11
1G6GT/G	p. p. class B 4.0
1LA4	7.0
1LB4	10
1N6G	7.0
1S4	12
1T5GT	7.5
2A3	single-ended class A_1 5.0 (2nd harmonic)
	p. p. class AB_1 5.0
2A5	single-ended class A_1 fixed bias 9.0
	cathode bias 9.0
	p. p. class A_1 fixed bias 4.0
	cathode bias 3.0
3A4	6.0
3LF4	series filament 8.5
	parallel filament 6.0
3Q4	series filament 7.0
	parallel filament 7.0
3Q5GT	series filament 8.5
	parallel filament 6.0
3S4	series filament 13
	parallel filament 12
3V4	series filament 7.0
	parallel filament 7.0
6A6	p. p. class B 8.0
6AC5G	10
6AC5GT	10
6AD7G	(pentode section) 8.0
6AG7	7.0
6AK6	10
6AQ5	single-ended class A_1 12
	p. p. class AB_1 3.5
6B4G	single-ended class A_1 5.0 (2nd harmonic) p. p. class AB_1 5.0
6B5	10
6F6, 6F6G, 6F6GT	single-ended class A_1 fixed bias 9.0, cath. bias 9.0; p. p. class A_1 fixed bias 4.0, cathode bias 3.0
6G6G	10
6K6GT	single-ended class A_1 15
	p. p. class A_1 4.0
6L6, 6L6G	single-ended class A_1 (tetrode conn.) fixed bias 15 cathode bias 11; single-ended class A_1 (triode conn.) fixed bias 5.0 cathode bias 6.0; p. p. class A_1 (tetrode conn.) fixed bias 2.0 cathode bias 2.0; p. p. class AB_1 (tetrode conn.) fixed bias 2.0 cathode bias 4.0; p. p. class AB_2 (tetrode conn.) 2.0
6N6G	5.0
6N7, 6N7GT	p. p. class B 8.0; single-ended class A_1 12
6V6, 6V6GT	p. p. class AB_1 3.5
6Y6G	10
7A5	10
7B5	single-ended class A_1 15
	p. p. class A_1 4.0
7C5	single-ended class A_1 12
	p. p. class AB_1 3.5
10	5.0 (2nd harmonic)
12A5	11
12A6	7.0
12L8GT	10
25A6	10
25A6GT/G	10
25A7GT/G	9.0
25AC5GT/G	10
25B5	9.0
25B6G	15
25C6G	10
25L6	10
25L6GT	10
25N6G	9.0
26A7GT	single-ended class A_1 (each unit) 7.0
	p. p. class AB_1 5.0
32L7GT	9.0
33	7.0
35A5	10
35B5	10
35L6GT	10
38	8.0
41	single-ended class A_1 15
	p. p. class A_1 4.0
42	single-ended class A_1 fixed bias 9.0
	cathode bias 9.0
	p. p. class A_1 fixed bias 4.0
	cathode bias 3.0
43	10
45	p. p. class AB_2 fixed bias 5.0
	cathode bias 5.0
47	6.0
48	9.0
50B5	9.0
50L6GT	10
53	p. p. class B 8.0
70L7GT	10
89	p. p. class B (triode conn.) 8.0
117L7GT	5.0
117M7GT	5.0
117N7GT	6.0
117P7GT	5.0
1602	5.0
1621	p. p. class A_1 (triode conn.) 1.0
	p. p. class A_1 (pentode conn.) 3.0
1622	p. p. class A_1 1.0
1631	same as 6L6
1632	10
1635	p. p. class B 5.0
1644	10

NOVEMBER SPECIALS

ARB RECEIVER 195-9050KC, 28VDC. New—Complete $49.50

BC-224 RECEIVER, 12 V.D.C. Input, Excellent condition $79.50

IDEAL MOBILE POWER SUPPLY
PE237 heavy duty vibrator power supply, 6, 12, or 24v input. 525v, 95 ma; 105v, 42 ma; 6.5v, 2 amp; 6v, 500 ma; 1.3v, 450 ma; small supply 100v, 17 ma; 1.35-450 ma with tubes, shock mounted—brand new $29.50

7 FT. CORD CD 1086 for PE237, GN58..... $1.95

BC-1306 SMALL COMPACT TRANSMITTER 3800-6500 kc, 3A4, 2E22, less cover. Can be used with PE237, GN58. New..... $9.95

K-7 GUN MOUNT ASSEMBLY, ideal mount for beam antenna, cable control. New..... $5.95
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100 Ft. STEEL MEASURING TAPE. NEW..... $5.95
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BRUSH DISPLACEMENT
Pickup DP-1, NEW..... $17.50

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DYNAMIC HEADSET and mike. New..... $1.95
SCR-522 Trans-Recv. with tubes, U-1..... $35.00
Plugs for SCR-522 N-1. Per set..... $4.00

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Interphone Amplifier BC-709B. Ideal for Aircraft, booster for telephones, etc., N-1..... $4.50
BC1206A-DETROLA. NEW..... $4.95

BC464 TARGET RECEIVER, 5 channel remote control, battery case and ant. 68-73 MC-N1 ..... $14.95

BC357J BEACON Receiver, 75 mc, tubes N-1..$3.45
G.E. BATTERY CHARGER: Tungar 6RB6B17, 12 battery, 12 amp; 24 battery, 6 amp. N-1..... $67.50
MN26 RADIO COMPASS RECEIVER, tubes 150-1500 KC, U-1, $18.95; U-2..... $14.95
SIGNAL BOX KITE, N-1..... $2.00

EE-8 TELEPHONE FIELD SETS with handset and ringer, N-1, $15.00 ea., $28.00 pr.; U-2, $10.00 ea., $18.00 pr.; U-3, $7.00 ea., $13.00 pr.

TUBE SPECIALS

5BP1	$1.15	726	$4.95	6L6G	$1.10
3AP1	2.25	75TL	2.50	12A6	.29
2X2	.75	5BP4	2.50	4 for	1.00
9002	.75	717-A	.69	VR150	.90

GIBSON GIRL SCR 578B transmitter for sending distress signals from boats. Trans., complete with balloons, hydrogen gens., kite and instal. manuals. N-1 Export packed..... $25.00
Transmitter only, tubes..... $6.95

EXTENSION CORDS, PL55 plug incl. N-1..... $0.49
HS-30 Ear Plug head set N-1, $0.95; U-1..... $0.50
MATCHING TRANSFORMER, HS-30..... $0.50

APN-1 ALTIMETER INDICATOR—Basic movement 0-1 ma, 5 ma shunt, 270° scale. An excellent basic G.E. movement for constructing your own meters. N-1..... $1.95
METER RECTIFIER, full wave midget Selenium, 10 volts, 30 ma. N-1..... $0.29

PL-55 PLUG, N-1, $0.24; 5 for..... $1.00
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BC733D GLIDEPATH RECEIVER, NEW..... $9.95
T-17 MIKE, NEW $1.50; Used..... $0.75
SCR-274 Remote tuning head, 3 crank..... $1.00

PE-103A DYNAMOTOR. N-1..... $12.95
CD-501A CABLE for PE-103A-BC654A..... $1.95
FRAME MOUNTING BC654A-103A..... $4.95

THROAT MIKE, $0.50; HAND KEY, N-1..... $0.50

BC-348 MOUNTING BASE Postpaid..... $2.50
BC-348 OUTLET PLUG, Postpaid..... $0.80
BC-348 MNTG. BASE and Outlet Plug, Postpaid $3.00

$1.00 TUBE SPECIALS
872A—1616—304TL—211; Minimum order: four tubes. NEW & CLEAN.

.25 Mfd.—20,000v G.E. Pyranol Cap. N-1..... $9.95
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T-32 DESK MIKE, N-1, $3.50; U-1..... $1.95
3 FT. DIAM. SIGNAL BALLOON. N-1..... $1.50
AN73, 7' ANT. TELESCOPES to 12". N-1..... $2.50
U-1..... $1.50
AUDIO CHOKE—1 Henry 800 ma, 15,000v Test. U-1..... $12.50
SOUND POWERED CHEST SET, N-1..... $5.95

GSAP 16 MM CAMERA, f3.5 lens, converted with viewfinder, battery case. EXCELLENT CONDITION $49.50

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6 COND. PLASTIC CABLE for Photoflash, N-1. Per foot $0.35

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100 AMP. TRANSTAT, 2 gang 0-115 volts, Catalog No. 29145, new..... $69.50

ANTENNA KNIFE switch, S.P.D.T. $0.49
PEERLESS A-4233Q line matching transformer—50/125/200/500 ohms, NEW..... $1.50

SURPLUS RADIO CONVERSION MANUAL
115 pages of circuits and data. Postpaid..$2.50

HS-23 8000 Ohm Headset, Used Good..... $0.69
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RM-13 REMOTE CONTROL UNIT contains EE8, handset, 1 stage amplifier, Weston DB meter, Used, 115v A.C. $15.00

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RM-29A Telephone

housed in steel cabinet. Uses a standard 4½ volt Radio "C" Battery. Shpg. wt. 16 lb.

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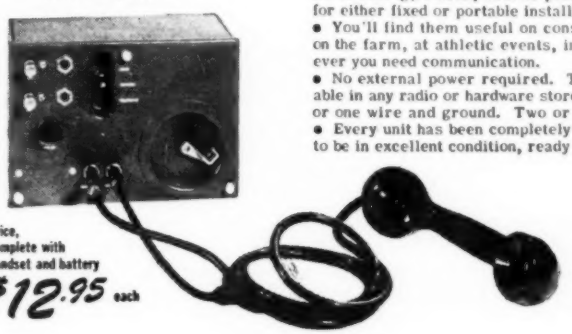

Price, complete with handset and battery **$12.95** each

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Brand New, Unused EE-8's
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Uses 2 standard flashlight cells. Shpg. wt. 12 lbs.

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525 FOOT ROLLS Stock No. C-561H Only **$4.95** per roll

Each conductor consists of four #28 steel strands for added strength and three #28 copper strands for extra conductivity and flexibility. Rubber insulation with two-ply waterproofed braid covering around each conductor. Net wt. 20 lbs. A wonderful buy for any telephone or inter-communication use requiring 2 or 3-conductor cable.

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3A5	.98	VR-150	.69	WL530	19.95	726A	4.75
3B24	1.95	VT-158A	4.90	WL531	19.95	801	.95
5AP1	2.49	211	.98	705A	1.85	804	3.75
5BP1	1.95	250R	4.95	708A	2.00	807	1.19
5BP4	1.95	388A	4.95	714AY	9.80	813	5.95
5J23	15.95						
5J29	15.95						

829	$ 2.95	1625	.49
832A	1.95	1626	.49
841	.69	1629	.29
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884	1.70	7193	.29
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oscillator frequency dial for lowest reading (null).

7. Read distortion percentage directly from meter scale.

Meter Switching for Increased Accuracy

The single linear meter scale shown on the instrument as described, was adopted for simplicity. On this scale, however, the commonly encountered distortion percentages fall near the lower end where the instrument accuracy is not good. A discriminating operator might object to this.

If the reader desires, increased accuracy can be secured by installing a single-pole, 3-contact meter range switch and two multiplier resistors in addition to R_3. The two extra multipliers will give distortion meter ranges of 0-10% and 0-5% for closer readings. The circuit modification is given in Fig. 4B.

It will be necessary to make special voltage calibrations of the meter circuit with the new multipliers and either to make two corresponding special meter scales (in addition to the present 0-100-microampere scale) or to prepare a conversion chart for reading the microammeter in distortion percentages. This is because the crystal rectification curve is not linear at the low voltages which correspond to these smaller percentages.

The circuit for the meter range switch is given in Fig. 4B. Typical calibration data is given in Table 1. These calibration points were taken with a representative 1N34 crystal. However, an individual operator must calibrate his own instrument on the 0-5% and 0-10% scales.

The calibration procedure is simple: (1) Connect variable-voltage a.c. source (0-1 volt, adjustable in 1/10-volt steps) to input terminals of distortion meter. (2) Throw distortion switch S_1 (See Fig. 4A) to *"SET."* (3) Throw meter range switch to 10% position. (4) Adjust input voltage in 0.1-volt steps, starting at 0.1 volt and progressing to 1 volt. (5) Record microampere and percentage readings on chart similar to Table 1 or inscribe special scale on microammeter. (6) Set meter range switch to 5% position and repeat calibration procedure, progressing this time from 0.1 volt to 0.5 volt.

When using the distortion meter, always set the meter range switch first to its 100% position, with switch S_1 at *"SET,"* and adjust gain control R_1 for full scale deflection. Then throw S_1 to *"READ,"* and change setting of meter range switch to give distortion indications in upper part of meter scale.

Operating Pointers

The audio oscillator used in distortion measurements must, for ease of operation and best accuracy, have good output waveform. Its own total distortion should be as low as possible.

False readings can be produced on the distortion meter by voltages due to noise, hum, or oscillation arising with-

in the amplifier under test. For this reason, it is advisable to make an aural test by means of the loudspeaker and to correct noise, hum, or oscillation before undertaking the measurement of distortion.

Much of the distortion commonly encountered in p.a. amplifiers arises in the output stage. The chart in Table 2 lists the tabular values of total distortion for output amplifier tubes operated at maximum power output. Distortion values differ somewhat for the same tube operated at different plate voltages or in a different class of amplifier (A, AB, B, etc.). The values in Table 2, however, are for the highest-output method of operation for each tube.

The voltage output of some amplifiers will not be high enough to give full-scale deflection of the distortion meter when switch S_1 is in its *"SET"* position. In such cases, it will be necessary either to employ a low-distortion 1- or 2-stage audio amplifier ahead of the distortion meter or to calculate the distortion percentage from the meter deflections that can be obtained. For calculations, first throw switch S_1 to *"SET"* and adjust gain control R_1 for the highest meter reading. Call this reading D_1. Then, throw switch S_1 to *"READ"* and record the lowest obtainable null reading as D_2. The distortion percentage is equal to $(D_2/D_1) \times 100$.

With a little practice, the distortion meter can be used with as much ease and simplicity as any non-electronic ohmmeter. Once its use has been mastered, this instrument will prove a useful adjunct to any amplifier service shop.

-30-

The first metal television receiving tube to be manufactured on a continuous production basis has been announced by Tel-O-Tube Corporation of America, which has solved the problem of joining glass to metal to obtain an air-tight seam. This giant new 16 inch direct view tube, now available in home receiving sets, provides a larger picture than an all-glass tube of the same diameter — nearly 150 square inches of image — because it "scans" without distortion almost to the outer edge of the picture screen. The metal tube is lighter in weight than an all-glass tube and provides better shielding against stray light and other interference, according to the tube's manufacturer.

NEW RECEIVERS for Winter Market

PROJECTION TV

Life-size television pictures for hotels, clubs, places of amusement, etc. are provided by the new *RCA Victor* commercial projector announced recently by *Radio Corporation of America.*

Featuring a reflective optical system, the pictures produced by the new projector may be tailored to suit screen sizes ranging from 3 x 4 feet to approximately 7 x 9 feet.

The Model TLS-86 is capable of producing an image about 63 square feet in area with the projector located 17 feet from the screen. A simple focusing system permits adjustment for a shorter projection throw, providing a smaller image. The unit may be mounted on casters for easy dollying

to the desired position in relation to the screen.

As simple to operate as the conventional home television set, the projector permits instant selection of a desired station. The controls are so arranged that all adjustment can be made without interfering with the projected picture. The sound system is a specially designed unit containing a 10" speaker in an acoustically matched cabinet and is designed for operation adjacent to the projection screen.

Additional information on the Model TLS-86 may be secured from *Radio Corporation of America, RCA Victor Division,* Camden, New Jersey.

LOW-PRICED TV

National Company of Malden, Massachusetts has announced two table model television receivers which will retail in the moderate price class.

The Model TV-7M features a 7" picture tube and provides coverage of all television channels. The circuit uses 21 tubes including three rectifier tubes and the picture tube. The company claims brighter pictures because of the full 4000 volts on the picture tube, coil switching which assures the equivalent of separate, high *"Q"* tuned circuits for each channel to improve sensitivity and stability, and automatic gain control.

A special extra-stable synchronizing circuit locks the picture in place and provides steadier pictures. The circuit uses a 37 mc. i.f. instead of the conventional 21 mc. thus minimizing picture interference caused by other radio services, according to the company. Double-tuned r.f. bypass circuits improve selectivity and image ratio. Fine tuning adjustment is provided. Two speakers and hum-free power supply are said to provide clearer, life-like binaural sound.

The Model TV-7W is identical to the TV-7M except that it is housed in a mahogany cabinet.

For full details on these new table model receivers address your requests for additional information to *National Company,* Malden, Massachusetts.

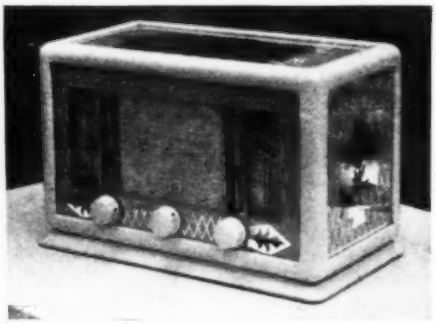
FRENCH SET

The Art Luxe & Technique Corporation of France is currently distributing two of its table model radio receivers in the United States through its New York office.

The Model E-500 is housed in a modern cabinet and covers the broadcast band from 535 kc. to 1600 kc. and two short-wave bands, 3 to 8 mc. and 8 to 23 mc. The set is a specially designed a.c.-d.c. superheterodyne for American use. Two easy-to-read dials are imprinted with the names of American and European stations.

Sensitivity is 5 microvolts at 1200 kc. Selectivity is 4 kc. at 6 db.; 10 kc. at 20 db.; and 18 kc. at 40 db.

The Model C-502 is an ultra-modern table receiver which offers the same tuning range as the Model E-500. A mirrored slide rule dial carries the



names of American and European stations. Bandpass is 40 to 6000 cycles with 4 db. maximum attenuation.

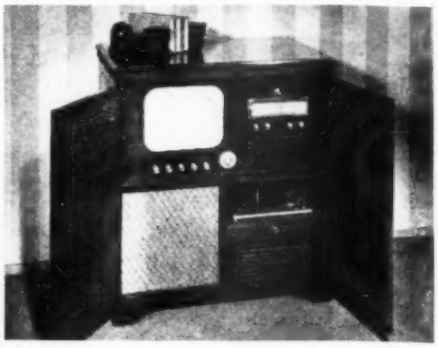
Both receivers use American made tubes and are constructed with standard radio parts. For further details write *The Art Luxe & Technique Corporation,* 220 West 42nd Street, New York, New York.

UST COMBINATION CONSOLE

United States Television Mfg. Corp. of New York has introduced a 12 inch television-radio-phonograph console which will be merchandised as a complete entertainment unit for the home.

Besides the 12 inch direct view television picture, the model has AM and FM radio and automatic record changing phonograph which can handle either 10 or 12 inch records.

The set is housed in a cabinet of mahogany finish which measures 39¾"x 33¾"x21½". The console is also avail-



able in bleached mahogany at a slightly higher price.

A unique feature of this model is that it uses a Zetka 12 inch tube with ion trap, the only 12 inch tube with this feature, according to the company. The trap prevents the formation of a brown ion stain which often appears on television tubes without this feature.

For further data on the new combination console, write to *United States Television Mfg. Corp.,* 3 West 61 Street, New York 23, New York.

EMERSON TV

A "4-way" period console which incorporates FM, AM, automatic phonograph, and television has been introduced by *Emerson Radio & Phonograph Corporation* of New York.

Known as the Model 585, this new console features a 52 square inch picture and incorporates a 10 inch tube. Full coverage of all existing television channels is provided. A minimum of operating controls appear on the front panel as installation controls for centering, linearity, size, drive, and focus are at the rear. The company's picture-lock automatic frequency control holds the picture steady at all times, while an a.g.c. circuit amplifies weak signals and reduces blasting of strong signals.

The FM band is covered from 88 to 108 mc. while AM reception is assured from 535 to 1620 kc. An internal FM power line antenna is said to eliminate the necessity for an external dipole in most reception areas. Terminals for external antennas for both AM and FM have been provided if such installation is desired.

The receiver uses a 12 inch Alnico PM dynamic speaker and features a

REVOLUTIONARY SOLDERING IRON

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- Weighs only 3 ozs., yet can do the job of a 200 watt iron
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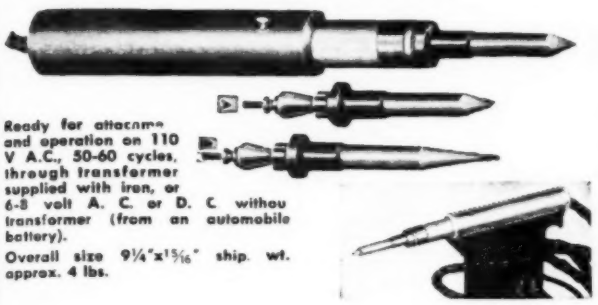

Ready for attachment and operation on 110 V A.C., 50-60 cycles, through transformer supplied with iron, or 6-8 volt A. C. or D. C without transformer (from an automobile battery).

Overall size 9¼"x1⅝" ship. wt. approx. 4 lbs.

- Ideal for fine precision work in "hard-to-reach" places.
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PRICE: including transformer and Tip-Head "A", $13.95

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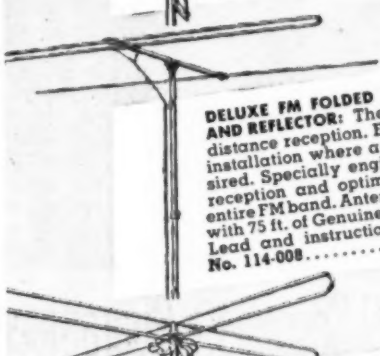
TELEVISION ANTENNA ARRAY: For complete and long-lasting television enjoyment, Amphenol Television Antenna, 114-005, is by far the best. Covers all channels in both high and low bands with high gain and complete freedom from unwanted side and rear responses. Perfect matching to the transmission line permits delivery of full signal strength to the receiver. It is rugged and weather resistant, eliminating costly repair and maintenance calls. It is packaged complete with mast, swivel base, guy clamp, all necessary hardware, and 75 ft. of Genuine Amphenol 300 Ohm Twin-Lead. Clear, concise instructions make it simple to install.
No. 114-005 ..... **List $27.50**

DELUXE FM FOLDED DIPOLE ANTENNA: Designed to provide perfect FM reception in areas of high and medium signal strength. This antenna is broadbanded over the entire FM range. The impedance is efficiently matched with the Genuine Amphenol 300 Ohm Twin-Lead which is included. Comes packaged complete with 75 ft. of transmission line and instructions for easy installation.
No. 114-001 ..... **List $12.25**



DELUXE FM FOLDED DIPOLE AND REFLECTOR: The perfect solution for long distance reception. Essential for the suburban installation where a directional pattern is desired. Specially engineered for the finest FM reception and optimum gain throughout the entire FM band. Antenna is packaged complete with 75 ft. of Genuine Amphenol 300 Ohm Twin-Lead and instructions for easy installation.
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DELUXE FM ALL-DIRECTION DOUBLE FOLDED DIPOLE: Receives FM broadcasts from all directions. A perfectly engineered turnstile type, designed with the same precision as used in the FM station antenna. Reception is equally balanced around full 360° to bring in all FM stations within normal service radius. Packaged complete with instructions for quick, easy installation. Includes 75 ft. of Genuine Amphenol 300 Ohm Twin-Lead.
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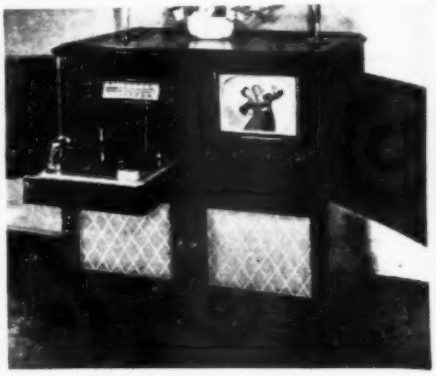
fidelity tone audio circuit with 5 watt beam power output. The automatic phonograph is installed on a slide-out panel for full-view record loading. The



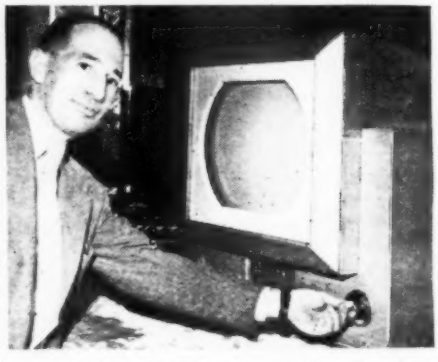
record changer will handle either 10 or 12 inch records and shuts off when the last record has been played.

For complete information on the Model 585 write to *Emerson Radio & Phonograph Corporation*, 111 Eighth Avenue, New York 11, New York.

METAL TUBE UNIT

Starrett Television Corporation of New York has announced production on a television receiver using the new *Tel-O-Tube Corporation of America's* 16" metal television receiving tube.

Known as the "Ambassador," the new receiver is a table model unit housed in either a mahogany or walnut cabinet. Reception of the AM and FM bands is provided in addition to television coverage. The set measures 25½ inches by 27 inches by 24½ inches and is said to weigh substantially less than previous large tube sets because the metal tube weighs



one-sixth of the conventional glass tube.

A viewing surface of approximately 150 square inches is provided with this set.

For full details, write *Starrett Television Corporation*, 521 Fifth Avenue, New York, New York.

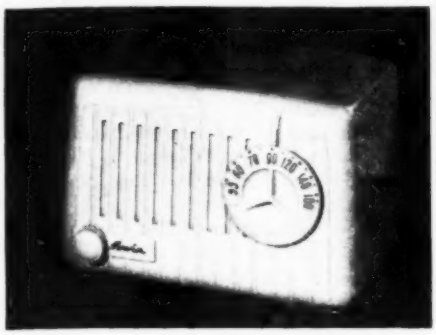
ARVIN TABLE MODELS

Distribution has started on the two latest additions to the *Arvin* line of table model radios, the 243T and the 253T series.

The 243T series is available in four colors, ivory, geranium red, banana yellow, and leaf green. The new series features seamless, mar-resistant metal cabinets, three tubes plus rectifier, and Underwriters' Laboratories listing.

Dial calibration is carried on the tuning knobs and the volume control knob acts as an off-on switch. The series has a.v.c., beam power output, an a.c.-d.c. superheterodyne circuit, and a 20 foot extendable antenna.

The 253T series is available in ebony,



walnut, or ivory plastic cabinets. It has four tubes plus a rectifier. Controls are the same as with the 243T series.

Noblitt-Sparks Industries, Inc. maintains its factory at Columbus, Indiana for the manufacture of the *Arvin* line of receivers.

FARNSWORTH TV UNIT

Farnsworth Television & Radio Corporation of Fort Wayne, Indiana is making deliveries on the Model 651-P, a new television receiver housed in a cabinet of modern design.

This table model receiver is available in a dark walnut finish and measures 16¾"x17"x22½". The set has a new type mirror-backed, flat-faced picture tube that assures a brilliant, steady, high definition image of 52 square inches. An exclusive feature of this set is an electronic beam "relaxor" which permits simplicity of electrical circuit design and more economical set maintenance and operation.

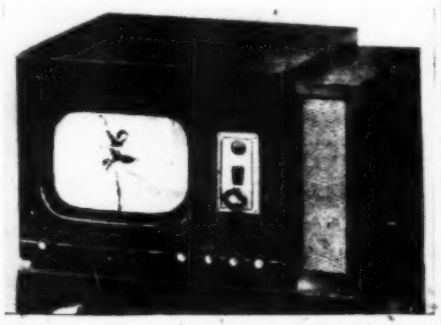
All operating controls are mounted on the front. The design also permits immediate access to all components in either the top or bottom of the chassis thus enabling service technicians to install and adjust the receiver to varying local conditions.

Farnsworth Television & Radio Corporation, Fort Wayne, Indiana will furnish additional details on request.

TABLE MODEL TV-FM

Stromberg-Carlson Company has added the Model TV 12 H1 to its line of table model receivers.

This television-FM receiver is housed



in a modern, pin-striped mahogany veneer cabinet. It features a twelve-

inch picture tube and provides coverage of all television channels in addition to the 88-108 mc. FM band.

Known as the "Rochester," the new receiver has a 5½ inch speaker system which is adequate for most television programs. In case symphonic or similar material is carried, provision has been made for connecting the set to a console radio or radio-phonograph to take advantage of the larger unit's audio and speaker system.

Further data on the "Rochester" may be secured from *Stromberg-Carlson Company,* Rochester 3, New York.

PORTABLE TV SET

Sentinel Radio Corporation of Evanston, Illinois has begun deliveries on a portable television receiving set.

This table-size set is capable of being carried from room to room, to the hospital bedside, to factory or office recreation room, college dormitories, summer homes, etc. wherever a.c. power line service is available.

The new portable unit has eye level vision, and a portable antenna. There is complete 4-knob control of channel, brightness, off-and-on volume and contrast. The case is an imitation grain leather, equipped with luggage type carrying handle.

For full details, write *Sentinel Radio Corporation,* Evanston, Illinois.

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Communications Receiver

(*Continued from page* 61)

mer C_{23} for maximum "R" meter indication.

Tune the signal generator to approximately 4910 kc. The image should appear at this frequency. It may be necessary to increase the signal generator output for this test.

If the image does not appear at 4910 kc. tune the signal generator to 3090 kc. and it will. This condition will mean the oscillator is tuned on the low frequency side.

Should this condition exist retune the oscillator so the image falls on the high frequency side.

Next tune the mixer trimmer C_{16} for maximum "R" meter indication. The signal generator frequency should be 4000 kc. for this and all other adjustments.

Connect the signal generator to the grid of the first r.f. stage and adjust trimmer C_{16} for maximum indication. Connect the signal generator to the antenna terminals and adjust trimmer C_2 for maximum.

During these adjustments it will be necessary to continually reduce the output of the signal generator to maintain an "R" meter indication of R8 or less.

Final adjustment is made by connecting an antenna to the tuner and adjusting each circuit for maximum sensitivity on a weak signal.

The oscillator injection voltage can be checked by connecting a 20,000 ohm-per-volt voltmeter or vacuum tube voltmeter across resistor R_{11} in the mixer circuit. This voltage should run between one, and one and a half volts, for maximum conversion gain. The voltage can be adjusted by varying the value R_{11}. Increasing the resistance will cause the voltage to increase. Injection voltage is coupled from the oscillator to the mixer by tube capacity.

The over-all gain of the tuner is determined by the value of the first r.f. stage plate shunting condenser C_8. If this capacity is decreased the gain will increase. Those desiring to increase or decrease the gain can do so by changing the value of this condenser. When this capacity is 100 $\mu\mu$fd. the following results are obtained; 2.4 microvolts with a 25 to 1 signal-to-noise ratio. The image rejection is 750 to 1.

The audio gain is reduced 5 to 1 by resistors R_3 and R_5 in the audio deck. If this voltage divider were removed the sensitivity would increase but the signal-to-noise ratio would decrease. Reducing the value of C_8 in the tuner will offer the same result. After a certain degree of sensitivity is reached, additional gain will only reduce the signal-to-noise ratio.

With the gain set as is and the volume control set at approximately 25 per-cent, a one watt audio level is available when received signals are above R3 meter indication. Fifty milliwatts is room volume.

Tuning Procedure—10 Meter Tuner

The tuning procedure for this tuner is much the same as the 75 meter tuner. Tuning i.f. line transformer L_4 is identical.

Frequency determining condensers C_1, C_9, C_{15}, and C_{21} are required to cover the 40 meter ham band. These condensers are ceramic 50 $\mu\mu$fd., soldered directly across the trimmer condensers. Condenser C_1 was shunted with an additional capacity of 10 $\mu\mu$fd. This may have been due to the tolerance of the 50 $\mu\mu$fd. condenser or a variation between coils.

After a tuner has been aligned the tension of the trimmer screw should be noted. If the screw is tight it is advisable to shunt the trimmer with an additional 10 $\mu\mu$fd. capacity and retune the circuit. This will reduce the amount of tension.

If the trimmer screw is loose after final adjustment the frequency determining capacity should be reduced and the circuit retuned.

The trimmer capacity is 30 $\mu\mu$fd. Increasing or decreasing the circuit capacity 10 $\mu\mu$fd. will correct this situation.

Connect the signal generator to the grid of the second r.f. stage and adjust the frequency of the generator to 7350 kc. Rotate the main tuning con-

denser to minimum capacity position.

Adjust oscillator trimmer C_{12} for maximum "R" meter deflection. Change the frequency of the signal generator to approximately 8260 kc. making sure the image appears on the high frequency side.

Return the frequency dial of the signal generator to 7350 kc. and adjust mixer trimmer for maximum. Connect the generator to the grid of the first r.f. stage and adjust the second r.f. stage trimmer C_{10} for maximum. Next connect the generator to the antenna winding and adjust the first r.f. stage trimmer C_2 for maximum.

Final alignment is made by connecting an antenna to the tuner and adjusting all circuits for maximum sensitivity on a weak signal.

The gain of this tuner is governed by the first r.f. stage plate shunt condenser C_5. The gain may be increased or decreased by changing the value of this condenser.

Coil difficulties were experienced in this tuner. A connection diagram is supplied with each *Miller* coil. This diagram shows grid, plate, "B plus," and a.v.c. terminals. Following this diagram resulted in an r.f. gain of less than one for each stage. By reversing the plate and "B plus" leads the gain was normal.

Connect the coils as the circuit diagram supplied with the coils indicates. If the stage appears to have no gain reverse the plate and "B plus" leads. It will only take a minute to make this change if necessary. This statement holds true for all tuners.

The sensitivity of this tuner is 1.5 microvolts with a signal-to-noise ratio of 25 to 1. The image ratio is 2200 to 1.

Tuning Procedure—20 Meter Tuner

The tuning procedure for this tuner is identical to the 40 meter tuner. The signal generator frequency for alignment should be 14,600 kc. with the main tuning condenser set at minimum capacity. The image frequency will be 15,510 kc.

The sensitivity is 2.7 microvolts with a signal-to-noise ratio of 25 to 1. The image ratio is 180 to 1.

In this tuner the plate shunt condenser C_5 is omitted. As the frequency is increased the r.f. gain per stage decreases.

The value of resistor R_{11} in the 20 meter tuner is 4700 ohms. In the 75 and 40 meter tuners the value is 25,000 ohms. The grid rectification of the mixer stage due to the injection voltage furnishes bias for the mixer stage allowing the cathode connection to ground.

The r.f. amplifier tubes in the 75, 40, and 20 meter tuners are 6SK7 type. 6SG7 tubes are used in the 10 meter tuner. The higher gain tubes make up for the reduction of gain due to the increase in frequency.

The gain can be increased in the lower frequency tuners by using 6SG7 instead of 6SK7 type tubes. The socket

connections are the same if number 3 and 5 tube socket connections are wired together per the wiring diagram.

A test was made using 6SG7 r.f. tubes in the 20 meter tuner. The sensitivity increased from 2.7 to 1 microvolt. The signal-to-noise ratio decreased from 25 to 1, to 12 to 1.

Reception of weak signals improved when the signal-to-noise ratio was 25 to 1 although the actual sensitivity was less. The builder can make this test and satisfy himself there is such a thing as too much gain if the same signal-to-noise ratio is not maintained.

Tuning Procedure—10 Meter Tuner

The tuning procedure for this tuner is the same as the other tuners. The alignment frequency is 29,800 kc. and the image frequency is 30,710 kc.

The sensitivity is 1 microvolt with a signal-to-noise ratio of 25 to 1. The image ratio is 120 to 1.

The image ratio of a single r.f. stage at 29,000 kc. may be in the order of 10 to 1.

It will be noted that the image ratio of each tuner does not change uniformly between tuners. This is due largely to the different values of frequency determining capacities shunting the grid coils.

Antenna Connections

The antenna terminals are available at the rear of each tuner chassis. Those desiring optimum operating conditions may connect antennas at this point. Those having individual antennas for each band will undoubtedly improve reception on the higher frequency tuners.

The antenna switch in the main tuner is a compromise between ease of operation and some attenuation in the antenna circuit due to mismatch of transmission lines and switch.

The operator can decide for himself by connecting the antenna through the switching network and directly to the tuner. If the attenuation is less than one "R" in either case, the switching losses are sufficiently low to disregard.

If the antennas are connected directly to the tuners disconnect the antenna lead going to the all-wave tuner switching network.

Dial Calibration

The *National* MCN dial is extremely simple to calibrate. The plastic pointer has three small holes drilled in it. By using one of these holes as a guide, a needle is used to make each calibration point. Three paper dial scales are furnished with each dial. This means the builder has three chances to make a neat dial calibration.

If the first dial lettering is not satisfactory another dial can be made without recalibrating. Simply place the unsatisfactory dial over a blank dial scale and mark the new dial by forcing the needle point through the first dial calibration points.

First make sure the tuner to be cali-

brated covers the desired frequency range. The only test equipment necessary for the calibration is a frequency meter. If the builder does not have such a piece of equipment it can undoubtedly be borrowed for the short time necessary.

First calibrate the dial every 100 kc. Identify each needle mark lightly with a pencil. Make sure the mark can be erased easily. Next calibrate every 50 kc. and identify these marks. Next calibrate every 10 kc.

Remove the dial and ink each needle mark by making a small dot. The 100 and 50 kc. points can be identified by a larger dot or line.

It is only necessary to identify the 100 kc. points with numbers. Since the dial scale is paper it can be numbered on a typewriter.

During the actual calibration, the dial assembly must be securely mounted to the chassis. The temporary dial mounting in the photograph is not satisfactory for this operation.

The dial calibration will be accurate within the ability of the operator to read it, taking into consideration the accuracy of the frequency meter used for calibration.

Frequency Drift

The frequency drift of the tuners is extremely low. The plate voltage for both the oscillator and mixer is regulated by the VR 150 tube on the power supply chassis. Oscillator plate voltage is low (approximately 70 volts).

Due to the low temperature rise in the tuners, frequency drift problems are minimized and the actual drift is considerably less than in the average communications receiver.

Although the tuners were designed for a specific application it is possible to make slight modifications and use the tuners in place of the r.f. end of existing receivers.

If an existing receiver lacks gain or has a high noise level when the audio gain is wide open with the antenna shorted, a marked improvement in reception will result by building one of the tuners.

The receiver power supply can furnish necessary plate and filament voltage to operate the tuners. If the receiver does not incorporate voltage regulation, the addition of a VR 150 is recommended but not absolutely necessary. This will simply improve frequency stability.

Five turns of number 36 wire wound close to the first i.f. grid coil in the receiver will be required to connect the tuner i.f. output to the i.f. section of the receiver.

Circuit connections necessary to connect a tuner to a receiver will vary with each make of radio. It is impossible to make a general circuit diagram that will work satisfactorily in each case.

Those having adequate receiver experience will have no difficulty in making such connections. Those lacking such experience should not attempt it.

(To be continued)

Sweep Generators

(*Continued from page* 48)

voltage of the scope itself and adjust the fine-frequency control (on the scope front panel) until a stable pattern is obtained.

The sweeping rate in nearly all sweep generators is 60 times a second, set by the local power line.

It was stated at the outset of this discussion that sweep generators designed for television sets used either a sinusoidal or a single saw-tooth sweep. Now, many of the sweep generators designed for AM and FM set alignment use the double saw-tooth sweep shown in Fig. 13 and yet none of the television sweep generators have this common type of sweep. The reason is due to the non-symmetrical response pattern that is characteristic of video i.f. systems. See Fig. 14. The double saw-tooth sweep produces a double pattern on the screen and by using this sweep, we would obtain either the double pattern shown in Fig. 15A or the double pattern shown in Fig. 15B. In either instance, the serviceman would be hampered in his alignment work. Hence, only sinusoidal and single saw-tooth driving voltages are employed in TV sweep generators.

That a double image or pattern is produced when a double saw-tooth driving voltage is employed can best be illustrated by an example. Suppose that in a generator employing this type of sweep voltage we set the front panel dial for a mid-frequency of 23 mc. with an over-all sweep of 6 mc. This means that the generator signal output will go from a low of 20 mc. to a high of 26 mc. In one complete cycle, the signal generator will go through this range twice, as shown in Fig. 13. Now, if the circuit being aligned possesses the response curve shown in Fig. 14, two complete patterns will appear on the scope screen. The patterns may appear side by side, as in Fig. 15A, or else superimposed, as in Fig. 15B. The first double pattern, Fig. 15A, will be obtained if the beam in the scope moves at one-half the frequency of the double saw-tooth wave. On the other hand, Fig. 15B will appear when the beam moves at a frequency equal to twice the double saw-tooth wave. In the latter case, one pattern is traced out, then the beam retraces rapidly to the left-hand side of the screen and the second pattern is traced out. When the response curve of the circuit under test is symmetrical, both curves blend together. However, because we have a non-symmetrical pattern in television i.f. systems, the two patterns can not be made to blend.

The following facts, in summary, should be kept in mind when using sweep generators with television receivers.

1. Determine the type of driving voltage employed in the sweep generator.

2. If it is sinusoidal, do *not* use the internal deflection system of the scope itself. Instead, obtain a sinusoidal voltage from the generator and connect this to the horizontal input terminals of the scope.

3. Adjust the phase control to obtain a single pattern.

4. When the generator uses a single saw-tooth wave, the internal deflection voltage of the scope can be used to drive the beam across the screen. In this case, the serviceman may tap off some of the saw-tooth voltage from the generator and apply it to the scope terminals marked *"EXT. SYNC."*

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Captain R. J. "Mike" Gibbons, a senior pilot for United Air Lines, and Robert W. Ellis, chief of mechanical service for the company at Seattle, both amateur radio operators, often get together off-duty to contact hams within the company. Since the two are neighbors, Captain Gibbons frequently stops by after a late trip to pick up news along the company's short-wave grapevine.

Technical BOOKS

"ELECTRIC EYE CIRCUITS AND RELAYS IN THEORY AND PRACTICE" by A. Edelman. Published by *Eby Specialty Sales Co.*, New York. 36 pages. Price $1.00 paper.

For years servicemen have been augmenting their income by building, installing, and servicing photoelectric relay equipment. Undoubtedly more of these technicians could enter this lucrative field with suitable training.

This book answers many of the questions about electric eyes that the engineer, electrician, technician, serviceman, inventor, experimenter, and student have been asking for many years. The text covers such subjects as light sensitive elements, light projectors, optical systems, photoelectric amplifiers, relays, stability, permanence, maintenance, power supplies, and typical photorelay circuits. The discussion has been confined solely to photoelectric devices.

Fifty diagrams have been used to illustrate the text material. A variety of circuits have been diagrammed covering various operating conditions and applications.

The book is written in non-technical, easy-to-understand language and should prove of value to persons interested in the rapidly expanding field of photoelectric equipment.

* * *

"LISTENING" by Albert N. Williams. Published by *The University of Denver Press*, Denver. 152 pages. Price $2.75.

This book is a compilation of a series of essays by one of broadcasting's most interesting and interested critics.

For years Mr. Williams has been "the voice crying in the wilderness" although now many columnists have entered the field as "radio critics." These essays while not unfriendly manage to hang the sword of public censure over the heads of the broadcasters by a very delicate thread.

Much of the material is howlingly funny but the point under discussion is well made and the quip doesn't detract from the question. Readers seeking technical information on radio won't find it here, but the listener, which means most of us, will find plenty of meat to digest for the future of radio *is* hanging in the balance whether we like to admit it or not.

* * *

"ELECTRON-OPTICS" by Dr. Paul Hatschek, translated by Arthur Palme. Published by *American Photographic Publishing Company*, Boston. 180 pages. Price $3.50. Second Edition.

This is a fundamental text on the science of electronics written for the layman and the student. No mathematical knowledge is required to understand the author's complete and simplified explanation of such phenomena as electricity flowing in a

vacuum, the recording beam, the nature of a light beam, refraction and the optics of image formation, photometric optics, lenses produced by electric and magnetic fields, the motion of electrons in the magnetic field, elementary and applied optics, resolving power and limit of enlargement, the television tube and the recording tube, the principles of amplifying tube design, electron multipliers, light-controlled multipliers, and voltage-controlled multipliers.

Two new chapters dealing with later developments and the shape of things to come have been added by the translator and Dr. Walter Hausz of *General Electric Company.*

The text is well and interestingly written and persons seeking a "speaking" acquaintance with electronics are invited to investigate this book. Numerous line drawings and photographs add clarity to the textual presentation.

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MIDWEST VIDEO NET

NETWORK television reached the Midwest late in September with St. Louis, Chicago, Milwaukee, Toledo, Detroit, Cleveland, and Buffalo linked by Bell System coaxial cables and radio relay systems.

By the end of the year, the Midwestern network will be linked to the East Coast Network, making it possible for one program to be broadcast by television stations connected to the hookup from the Atlantic Coast to the Mississippi River.

Service is provided in both directions between St. Louis, Chicago, Toledo, Detroit, and Cleveland and branches carry programs to Buffalo and Milwaukee. The television channels are furnished by coaxial cables, with the exception of the Toledo-Detroit and Chicago-Milwaukee links where radio relay systems are employed.

Work on the coaxial cables in the Midwestern network began in May, 1946, with the laying of the Buffalo-Cleveland cable. The Terre Haute-St. Louis cable project was started before the war but its completion was delayed until 1945.

Work on the Chicago-Terre Haute and Cleveland-Toledo sections was begun in February, 1947. In August of that year, the Chicago-Toledo segment was started. All cable segments have been in use for long distance telephone service for some months, while additional channels were being equipped for television transmission.

Construction of the radio relay systems in the network was begun during the spring of this year. Three intermediate towers were built between Chicago and Milwaukee and two between Toledo and Detroit. Terminal equipment was installed at the Michigan Bell Telephone Company building in Detroit, the Ohio Bell Telephone Company building in Toledo, the Illinois Bell Telephone Company's long distance center in Chicago, and at the Wisconsin Telephone Company toll building in Milwaukee.

The Eastern television network now in operation includes Boston, New York, Philadelphia, Baltimore, Washington, and Richmond. The New York-Boston route is radio relay, the remainder is coaxial cable.

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Manufacturers' Literature

Readers are asked to write directly to the manufacturer for the literature. By mentioning RADIO & TELEVISION NEWS, the issue and page, and enclosing the proper amount, when indicated, delay will be prevented.

BROADCAST EQUIPMENT

Federal Telecommunication Laboratories, Inc. has just issued five new data sheets covering three radio links and two pieces of broadcast test equipment.

One pamphlet covers the FTL-10-A 23 voice channel radio link system which is designed primarily for use as a simplex or duplex telephone circuit. The system uses the pulse-time method of modulation with time-division multiplex. The primary carrier of energy is a microwave radio frequency signal utilizing highly directed beams. This publication covers overall operation, general characteristics, terminal equipment, radio frequency equipment, antenna equipment, auxiliary equipment, and installation information. This data sheet has been designated "Radio Links 1."

The second publication, "Radio Links 2" deals with a frequency modulation u.h.f. radio link and covers special features, general details, receiver, transmitter, mechanical equipment, antenna, and technical characteristics. The unit is designated the FTL-11-A.

The FTL-13-A frequency modulation u.h.f. broadband radio link for multichannel telephone service is covered in the third publication, "Radio Links 3." Features, general applications, transmitter, receiver, antenna, application diagrams, and technical characteristics are discussed.

The two publications dealing with test equipment cover the FTL-15-A all-metal dummy antenna for FM broadcast transmitters and the FTL-12-A, a television broadcast transmitter monitor. These pamphlets have been designated "Test Equipment 1" and "Test Equipment 2" respectively.

Copies of any or all of these data sheets may be secured by writing *Federal Telecommunication Laboratories, Inc.*, 67 Broad Street, New York 4, New York. Please request these publications by pamphlet designation and equipment number.

* * *

MINIATURE TUBES

A new folder cataloguing the complete *RCA* line of miniature electron tubes has been prepared by the Commercial Engineering Section of the *RCA* Tube Department and is now available for distribution.

Covering 64 miniature types, the new folder, MNT-30B, supersedes the Tube Department's MNT-30A and includes sixteen additional types. Complete and up-to-date technical data is provided.

For quick and easy reference, miniature tubes are listed numerically and alphabetically, with short descriptions and metal and GT equivalents of each tube opposite the listings. Tubes are classified by type and function in a simplified chart on the first page.

Complete characteristics on each tube, together with operating conditions for typical use, are provided in a characteristics chart which is arranged for easy reference. Base diagrams furnish a quick guide to terminal connections.

The new MNT-30B Miniature Tube Folder is available free of charge from *RCA* Tube Distributors.

* * *

SOLDER BULLETIN

Points to consider in determining solder grade and size for a given job, melting points, and feet-per-pound of various sizes and grades, together with other information of value to solder users are described in a new solder bulletin just issued by *Division Lead Company* of Chicago.

Also included are four-color illustrations of the company's unique new "Solder Saver Snap-On Metal Covers" used on *Divco* one-pound solder spools. The metal spool cover snaps on and off easily. The cover protects the solder from dents and abrasions, keeps it bright and clean, and prevents uncoiling and waste.

Illustrations and descriptive material covering the company's acid core solder with non-liquid flux and the rosin core solder with the rosin dimer flux are also included.

A copy of the bulletin may be secured by writing *Division Lead Company*, Dept. 208, 836 W. Kinzie Street, Chicago 22, Illinois.

* * *

QUARTZ CRYSTALS

A new catalogue covering a complete line of quartz crystal units has just been released by *Reeves-Hoffman Corporation* of Carlisle, Pa.

The new bulletin, RHC-X, illustrates the variety of crystal holders available for special purpose calibration, mobile, aircraft, commercial, and marine radio use. Featured in this new publication is a small, universal crystal holder with a frequency coverage from 50 kc. to 100 mc.

For a copy of Bulletin RHC-X write to *Reeves-Hoffman Corporation*, 321 Cherry Street, Carlisle, Pa.

* * *

RADIART PROMOTION

The Radiart Corp. of Cleveland is currently using a new counter card to promote its line of *Radiart* Aerials for autos.

The card displays four of the company's line of aerials which feature

chrome plate finish and quality leads for noise-free performance. The aerials are weatherproof and will not short out from rain or snow.

Dealers wishing further details on these counter cards should write the company, *The Radiart Corp.*, Cleveland 2, Ohio.

* * *

SALES AID

The Electrical Division of *Olin Industries, Inc.* is offering two new point-of-sale aids for dealers handling the company's new *Winchester-Olin* interlocked flat cell radio batteries.

An appealing window streamer, in color, features an attractive girl in a bathing suit holding a portable radio, a sales message, and reproductions of the Winchester "A" and "B" batteries.

The second item is a lithographed card, in color, for a counter display. Space is provided for the insertion of a live battery.

Dealers interested in securing these sales aids should address their requests to Electrical Division, *Olin Industries, Inc.*, New Haven, Conn.

* * *

RCA SOUND CATALOGUE

The Engineering Products Department of *Radio Corporation of America* has just issued an 84-page illustrated catalogue listing the company's complete line of sound equipment.

The new booklet is divided into sections dealing with such sound products as microphones, amplifiers, speakers, program control and distribution facilities, and specialty products. Each section, in turn, presents a comprehensive list of products designed to meet needs ranging from those of portable systems to those of giant sound installations.

Concise descriptions of each model include such information as special features, uses, and specifications, as well as photographs and diagrams.

Copies of the new catalogue may be obtained on request by writing Sound Products Section, Engineering Products Department, *Radio Corporation of America*, Camden, N. J. Please specify the "Sound Products Catalogue #218-P."

* * *

AMPHENOL CATALOGUE

The new issue of *Amphenol's* catalogue A-1 covering AN connectors and fittings is now available to manufacturers and those engaged in procurement of these items for the Armed Services and industry.

Comprehensive in content, the catalogue contains a wide assortment of Army-Navy electrical connectors presented in a simplified manner. Each page gives specifications as to number of contacts, current or wire size, voltage or contact spacing. Illustrations show the assortment of insert arrangements available, and the number and size of contacts and mechanical spacing is tabulated.

AN fittings are presented with information required to make a selection and are indexed in numerical sequence for ready reference, dimensions, and functional diagrams. In-

serts are numerically listed by the Army-Navy numbers and cross-checked by page reference as to available types of shells and constructions.

Requests for catalogue A-1 must be made on your business letterhead. Write direct to *American Phenolic Corporation*, 1830 South 54th Avenue, Chicago 50, Illinois.

* * *

MASCO SOUND SYSTEMS

Mark Simpson Manufacturing Company, Inc. of Long Island City, New York has just released its catalogue No. 48 covering the company's complete line of sound equipment.

Included in the 24-page catalogue are amplifiers, portable sound systems, microphone mixers, remote-control amplifiers, mobile equipment, disc recorders, transcription players, musical instrument amplifiers, speaker cabinets, microphones, speakers, magnetic horn units, and accessories.

Complete specifications, application data, and descriptive material is provided for each item covered. A price list is included with the catalogue.

For a copy of catalogue No. 48 write to *Mark Simpson Manufacturing Company, Inc.*, 32-38 Forty-ninth Street, Long Island City 3, New York.

* * *

ALLIED'S 1949 CATALOGUE

Allied Radio Corporation of Chicago has just released its 1949 catalogue, a 180-page buying guide to "Everything in Radio and Electronics."

Designated catalogue No. 117, the new publication contains complete listings of radio and electronic parts, test equipment, batteries, p.a. systems, radios, radio-phonographs, televsion sets and components, recording equipment and accessories, changers and playback equipment, phono motors, amateur equipment, radio builders' kits and supplies, tools, books, diagrams, and a wide variety of other items in the electronics field.

The new 1949 catalogue is available free on request from *Allied Radio Corporation*, 833 West Jackson Boulevard, Chicago 7, Illinois.

* * *

BUSINESS AIDS KIT

Sixteen of the *RCA* Tube Department's most valuable "aids to better servicing" have been combined into a single "Business Aids Kit" now being made available to radio dealers and servicemen through *RCA*, *RCA Victor*, and *Cuningham* tube distributors.

An 8-page cartoon brochure describes how the service aids package is designed to help servicemen speed up repair work, cut corners, and eliminate some of the "bugs" that bottleneck shop operation.

The brochure lists each of the most common service shop "bugs" and shows how one of the service aids can be used to handle the problem. Included are the company's new "Triple Pindex," the resistor code automatic pencil, the *RCA* Receiving Tube Manual, the companion quick reference booklet on receiving tubes, the Tube Movement and Inventory Guide, the *RCA* "Radio Service" decal, etc.

Interested dealers and servicemen should see their *RCA* tube distributor for full information on the "Business Aids Kit." —30—

The Twenty-Fifth Board of Directors of the Radio Manufacturers Association are from left to right (top row) Ray H. Manson, Ernest Searing, E. A. Nicholas, J. J. Kahn, Vice-President R. E. Carlson, Vice-President W. J. Barkley, Vice-President G. M. Gardner, Frank M. Folsom, R. C. Sprague, Larry F. Hardy, and Benjamin Abrams. Second row (left to right) H. C. Bonfig, W. A. MacDonald, Joseph Gerl, Walter Evans, W. R. G. Baker, President Max F. Balcom, Treasurer Leslie F. Muter, Paul V. Galvin, E. Alschuler, F. R. Lack, and G. W. Thompson. The third row includes: H. C. Mattes, Thomas A. White, Ray F. Sparrow, J. H. Stackpole, Vice-President Allen Shoup, Vice-President A. D. Plamondon, Jr., W. P. Hilliard, Allen B. DuMont, G. Richard Fryling, and H. L. Hoffman. The bottom row (from left to right): H. J. Hoffman, Herbert W. Clough, S. Insull, Jr., A. Blumenkrantz, John W. Craig, Executive Vice-President and General Manager Bond Geddes, Gen. Counsel John W. Van Allen, George Lewis, Lloyd H. Coffin, D. Wald, Geo. R. Haase, and H. G. Sparks. This board will serve for term of 1948-49.

What's New in Radio

(*Continued from page 84*)

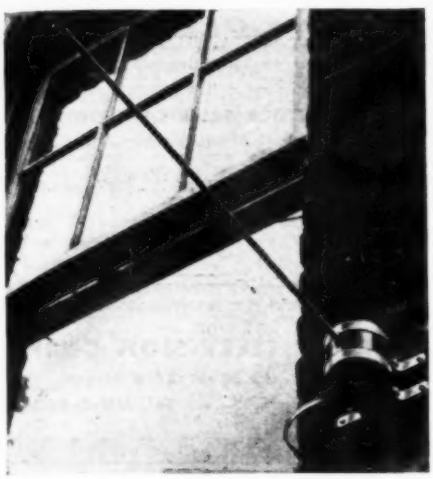
stub until the point of best signal is reached.

A data sheet and chart of antenna lengths for different bands is available. Write to *Marino Radio Co.*, 203 Greenwich Street, New York 7, New York.

VERTROD ANTENNA

Vertrod Corporation of New York is currently marketing a new series of rod-type, all-channel TV-FM-AM antennas which represent a departure from the dipole theory.

The new unit mounts on the outside of a window where it projects no more



than 45 inches and selects a stronger signal. The unipole, according to the company, has proven effective in cases where rooftop installations are impractical or not allowed, such as in multiple dwellings, private homes, etc.

Each of the rod antennas has a patented adjustable base allowing 180 degree rotation in the horizontal or vertical plane. The rod-type antenna makes a simple, low-cost installation, and is circuited for 300 or 72 ohm transmission lines. Two models (TV-FM and TV-FM-AM) feature weather-resistant aluminum alloy parts. The models differ in the network contained within the hermetically sealed housing.

Descriptive literature and further information is available from *Vertrod Corporation,* 11 Park Place, New York, New York.

CHASSIS PUNCH

The *Pioneer Broach Company* of Los Angeles is marketing a new chassis punch which cuts square holes in sheet metal and simplifies the job of attaching otherwise "hard to mount" parts by allowing this work to be done in a rapid and easy manner.

The new punch method is not limited to square holes. In addition, angular, rectangular, L-shaped, or any square corner pattern type hole can be cut with precision and ease. It is merely a matter of making combination cuts, if necessary, to achieve the desired pattern.

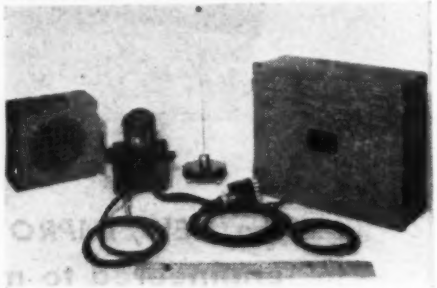
This chassis punch was designed specifically for the radio and electronics field although it may be used equally well in mechanical fields. At present the punch is made in two square sizes, ⅝" and ¾".

Complete descriptive material is available on request to *Pioneer Broach Company*, 1424 South Main Street, Los Angeles 15, California.

NEW MOBILE UNIT

Communications Company, Inc. of Coral Gables, Florida, is currently introducing the Model 275-C mobile radiotelephone unit which has been especially designed for police, taxicab, fire department, railroad, and other mobile applications in emergency service operating in the 152-162 mc. FM band and other FM services operating above 30 mc.

The Model 275-C is of single unit construction and measures 13" x 11" x



5". It is completely self-contained with the transmitter, receiver, and power supply in one compact unit. The unit may be mounted either flat or vertically and weighs only 20 pounds.

For automobile installation it is mounted on the firewall like a broadcast receiver thus conserving trunk space. A small control box with microphone hangup mounts on or under the dash. The set uses new, low-cost receiving tubes throughout and uses three low-priced transmitting tubes. Transmitter power output is 8 to 10 watts. The set employs a single heavy-duty vibrator power supply using only one long-life non-synchronous vibrator supplying two high voltage outputs. Only 13 amperes total drain from the car battery is required to produce the 8 to 10 watts output.

For complete data on the Model 275-C address your inquiries to *Communications Company, Inc.*, 300 Greco Avenue, Coral Gables, Florida.

NEW SCREWDRIVER

Of interest to radio servicemen is the new *Vaco Products Company's* duplex reversible screwdriver which accommodates both the Phillips and regular type screws by merely reversing the blade.

A positive spring action clutch in the center of the shaft provides foolproof chucking which allows no wobble yet permits easy and fast reversing operation. The "Amberyl" handle is Slo-Burning for safety, has fluted edges chamfered for comfort, with deep flute vacuum grip, and bears the Underwriters' Laboratories reexamination service marker. It is shock and

break resistant and is impervious to most alkalies and acids.

The new tool is available in two sizes, one with a No. 1 Phillips point and 3/16" regular point, and the other

with a No. 2 Phillips point and a 1/4" regular point.

For further information on the new reversible blade screwdriver write to *Vaco Products Company*, 317 East Ontario Street, Chicago 11, Illinois.

HIGH "Q" CHOKES

Chicago Transformer, Division of Essex Wire Corporation, is currently marketing two new compact high "*Q*" chokes.

Although designed specifically for use in dynamic noise suppressor circuits, the NSI-1 and NSI-2 reactors can be used in any tuned circuits requiring the given inductance.

Inductance values, 2.4 and .8 henrys respectively, are accurate within plus or minus 5% with up to 15 ma. of direct current. Units have a minimum "*Q*" of 20.

The two chokes are mounted in identical drawn steel cases and are very

compact, measuring only 1 11/16" by 2 3/8" by 1 7/16" over-all.

For complete data on the new high "*Q*" chokes, write direct to *Chicago Transformer*, 3501 W. Addison Boulevard, Chicago, Illinois.

NEW TV ANTENNA

A new television antenna which the manufacturer claims will increase the range of television and FM sets in fringe areas by as much as 15 to 25 miles has been developed by *Eastern Transformer Company, Inc.* of New York.

The "Double U" antenna uses three reflector elements, two director elements and two collector elements. The new unit features ease of assembly and installation; mechanical stability of design and operation; correction of ghost images; comparatively low cost; and elimination of unwanted sound and picture disturbances caused by

automobiles, x-ray, and diathermy equipment, according to the manufacturer.

The elements are packed ready for assembly on a galvanized steel 10 foot pole which, in most cases, gives sufficient height when used in any chimney or other mounting base. All connecting screws and hardware are heavy chromium plated to withstand corrosion. It is said that two men can assemble the new antenna in 30 to 45 minutes with only a screwdriver and a socket wrench.

For further information write *Eastern Transformer Company, Inc.*, 147 West 22nd Street, New York 11, New York.

SHURE MICROGROOVE PICKUP

The new 900MG crystal phonograph pickup for Microgroove records is currently being marketed by *Shure Brothers, Inc.* of Chicago.

The pickup tracks at 7 grams and has a needle force of 9 grams as an added safety factor. The unit uses a

special offset osmium-tipped needle with a point radius of only .001" and has an output of 1 volt.

The *Shure* lever system has been adapted in the development of this new pickup thus providing high needle compliance.

For further information on the 900-MG pickup write direct to *Shure Brothers, Inc.*, 255 West Huron Street, Chicago 10, Illinois.

TV ANTENNA ADAPTER

A high frequency television antenna adapter for those wishing to tune in Channels 7 to 13 has been announced by *Technical Appliance Corp.* of Sherburne, New York.

The new unit, consisting of a half-wave folded dipole with reflector as well as a quarter-wave connecting link with the existing antenna, has a matching network so designed that instead of the usual loss that occurs when loading one antenna with another, a gain is achieved over the low band.

The Type 445 high frequency antenna adapter is supplied with an aluminum tubular mast extension which

mounts to the mast of the existing low frequency antenna assembly by means of a coupling clamp.

The adapter may be oriented independently of the low frequency antenna thus providing satisfactory reception by minimizing ghost troubles.

For further information on the *Taco* Type 445 high frequency antenna adapter write to *Technical Appliance Corp.*, Sherburne, New York.

SOLDERING ELECTRODE

The *Cal-Perry Corporation* of East Orange, New Jersey, is currently marketing a new and improved soldering iron tip for use with electric soldering guns.

The new tip, which has been successfully field tested in the radio and television fields, features a chromium plated copper electrode with only the surface of the tip exposed to prevent heat loss. Heating time is only 9 seconds. The heat generated is sufficient to cover average soldering needs and often eliminates the need for heavier irons.

For further details on the new tip write to *Cal-Perry Corporation*, 62 Franklin Street, East Orange, New Jersey.

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International Short-Wave
(*Continued from page* 130)

land, FOVA, Radiosektionen, Germany, via Denmark. (Engdahl, Sweden) However, a more recent report on a Swedish DX Program said this station had "left the air for good."

Greece—Radio Athens, 15.345, is an excellent signal in daily beam to the United States beginning 1730, news at start. (Ormond, N. C., Glenn, Pa.) Is using 9.605 to relay Home Service in its "morning" transmission, replacing 6.175; on at 0000 with Greek recordings; 0015 Greek National Anthem followed by news in Greek; 0030-0100 music. On Sundays *only* relays religious program at 0100-0130 then fades out in North Africa; may not be complete schedule. (Bluman, North Africa, via Radio Australia)

Pearce, England, reports he hears the Democratic Greek Radio on approximately 6.835; has news in French 1400; closes down 1410; frequently says *"Vive la Republique et vive Gen. Markos."*

Haiti—A *new* outlet in Port-au-Prince, reported by Kary, Pa., is on 6.406, heard to 2030 sign-off; programs appear mostly recorded symphonic music; poor modulation.

HH2S, 5.94, Port-au-Prince, is heard 1830-2035; at least some days has *English* talk 2030-2035. (McPheeters, La.)

Hawaii—Latest schedule of KRHO, Honolulu, relaying programs from continental U. S. is—15.250, 0400-1005, to China-Philippines; 17.800, 0230-0345 (*not* Mondays to China-Philippines with UN broadcasts.

Honduras—Kary, Pa., reports HRA,

Tegucigalpa, on a *new* frequency of 6.049, announcing "Transmita HRA, La Voz de Lempira en Tegucigalpa, capital de la Republica de Honduras." News in Spanish of Central and South America 2055-2100, usually preceded by bugle call; with identification announcement, normally three chimes are sounded. Signals are only fair with considerable static and rather severe teletype and CWQRM.

India—Radio Australia reports the *new Decan Radio*, Hyderabad, on 730 kc. and 3.335 at 2200-2330, 2330-0330, and 0630-1300; and on 6.170 at 0730-1230.

Iran—Radio Teheran now closes on 6.155 at 1300; re-opens to Europe on 15.100 at 1330, runs to 1430; news 1410. (Bluman, North Africa, via Radio Australia) However, some days the 15.100 runs as late as 1500, usually last half hour being Western dance music. (Pearce, England) I have heard it that late recently here in West Virginia. The 15.100 channel also carries news 0615 now.

Israel—In verifying by letter for Kary, Pa., Kol-Israel, Tel Aviv, Broadcasting Station of the State of Israel, stated the transmitter is *not* of only a few hundred watters power, but a medium-size station (they did *not* list actual power); antenna is a dipole which has a general direction towards the United States; transmissions scheduled 2145-2230 (this one is heard fairly well in Eastern U. S.), 0000-0015, 0230-0500, 0600-0630, 0930-1330. It was explained "There is no other *official* broadcasting station in Israel for the time being besides a very small experimental one in Jerusalem which surely you can not receive as its power is in the order of 50 watts." Asked for further reports and was particularly interested in learning identity of the A1 teletype which sometimes blocks signals (6.830).

Woman reads *English* news 1230-1245. (Pearce, England)

Italy—Radio Italiana, 11.810, is an excellent signal in North Carolina in the daily beam to South Africa 1600-1630, news 1645. (Ormond)

Beams 1030-1200 on 15.120, 11.810, to East Africa; 1215-1550 on 9.63, 11.810, to Europe and North Africa; news 1450; beams to South Africa 1600-1630 on 6.085, 11.810, news 1615. (Bluman, North Africa).

Java—Radio Indonesia, 17.630, 19.345, 15.145, still signs on French program at 1200 with "March Lorraine." (Pearce, England)

Korea—HLKA, 7.935, Seoul, 5 kw., in verifying by letter for Pearce, England, gave schedule 2100-0000, 0300-0900, 1600-1830; *no English* but does broadcast some classical Western music. Is being heard again early mornings on both East and West Coasts of U. S. May announce occasionally in *English* as Korean Broadcasting System.

Libya—ISWC, London, reports Forces Broadcasting Station, 11.850, around 1545.

Manchuria—Dilg, Calif., reports

XNNR, approximately 7.097, heard mornings with news 0800, announcing location of "Liberated Manchuria." Announcer is on "nightly at 10 o'clock Shanghai Daylight Saving Time." Dilg first heard this station on about 8.844, hence seems to have moved. Appears to sign off 0930. Announced frequency of 7.100. Signal this fall has been fairly good, Dilg reports. A check by *Radio Australia's* monitor in Singapore revealed this station announces *both* 7.100 and 10.258, is heard daily and Sundays from around 0800 to 0920 sign-off; news 0805-0815, followed by program in Japanese.

Mauritius—Despite much publicity recently to schedules of a station said to be operating from Mauritius, Laubscher, South Africa, has received this information from the station: "At present we have *only* a 5 kw. Marconi for medium-wave transmission. I hope that by March next year (1949) we will be in a position to launch a 1.5 kw. *new* short-wave transmitter." Letter was signed by the manager, Mauritius Broadcasting Service.

Monaco—Radio Monte Carlo, 6.035, recently was heard by Pearce, England, in *English,* when woman announcer asked for reports. Heard well in England 1300-1715 sign-off, also in "morning" session which signs on 0100 with march; signs off with dance tune. French is mostly used.

Mozambique—Gillett, South Australia, says Lourenco Marques is heard on about 9.725 around 0820 then has interference from XGOA, Nanking, 9.730; programs are in *English* with usual advertisements. Identifies as "Lourenco Marques for happy listening." Has been heard for some months by West Coast listeners. (Dilg, Calif.)

Northern Rhodesia—Lusaka's 9.710 channel has been a good signal lately on West Coast, opening 1000 with news. Seems much stronger than same time last year; increased power? (Dilg, Calif.)

Norway—Oslo is again using 6.130 for its Home Service. (Bengtsson, Sweden)

Oslo has advised Worris, N. Y., that the fanfare used at the beginning and end of programs has no name. "The fanfare has been specially composed as signature tune for our short-wave transmissions," it was pointed out, "and is built around a very old motif from a Norwegian folk-tune."

Okinawa—OJYN, 19.845, has been heard frequently around 2200 contacting San Francisco; low level and uses but a few words of straight speech, then switches to inverted speech; frequency measured 19.870. (Kary, Pa., Arthur, W. Va.)

Pakistan—Geo. Major, W. Australia, airmails me that *Radio Pakistan* has been heard on approximately 6.062 from 0900, news in *English* 1030-1045; announces *"This is Radio Pakistan."* Signal good but has sideband interference from *Radio Tananarive* (listed 6.064). Gillett, South Australia, also reports this one and says it carries Indian-type program at 1000; Gillette

gives frequency as 6.085 and says appears either quite low-powered or is beamed away."

Panama—In verifying for Seebold, Calif., HP5A, Panama City, gave frequency 11.700, power 1 kw.

HP5K, 6.005, Panama City, is heard in Louisiana around 0630. In verifying via airmail QSL card, HOLA, 9.505, 1 kw., Colon, *Radio Atlantico*, listed schedule in *English* 0900-1100, 1500-1800, 2100-2200; in Spanish 0800-0900, 1100-1300, 1800-2100. (McPheeters, La.)

Philippines—Dilg, Calif., has received some interesting information from WVTM regarding reception of that medium-wave station on high frequencies last spring. The latter stated, in part, "Our answer is the same as your suspicion—Signal Corps radiations; that is, with the exception of April 14, 1948, on 9.790, which was planned. WVTM is a standard broadcast station with a power of 1 kw., operating on 1300 kc. We have no authorized short-wave frequency, except on special occasions when we operate as a relay station for other AFRS stations. Our transmitter and antenna are located at the Air Force Short-Wave Antenna Field, and although all equipment is supposed to be well shielded, evidently our signal is 'leaking' through to other transmitters, resulting in radiations. We would be interested to note if you are still reading us on short-wave frequencies which you had previously noted." In spring Dilg heard this station about every 7 kc. in vicinity of 10.50 and on 9.790 on April 14 (when seemed a fundamental according to quality at that time); not heard lately, Dilg says. QRA of WVTM is Hq. 13th Air Force, A.P.O. No. 710, San Francisco, California.

First reported to me by Dilg, Calif., and later confirmed by Gillett, South Australia, is KZMB, 6.005, "*The Voice of Manila,*" heard best around 0730. Gillett says this station formerly operated *only* on medium-wave. *Radio Australia* says is heard from around 0500, announcing "This is MBC, the Manila Broadcasting Company, the 'Voice of Manila.'"

KZPI, approximately 9.500, has been a good signal lately in South Australia to closing 1105; announced power is still 250 watts with 1 kw. used on medium-wave 800 kc. outlet in parallel. (Gillett)

"Voice of America" stations in Manila are scheduled—Manila I, 11.890, 0400-1105 to Far East; Manila I,

IMPROVING BASS RESPONSE OF G.E. MAGNETIC PICKUP

BY DR. JAMES LASSITER

THIS circuit was devised by the author for improving the bass response of a General Electric magnetic pickup.

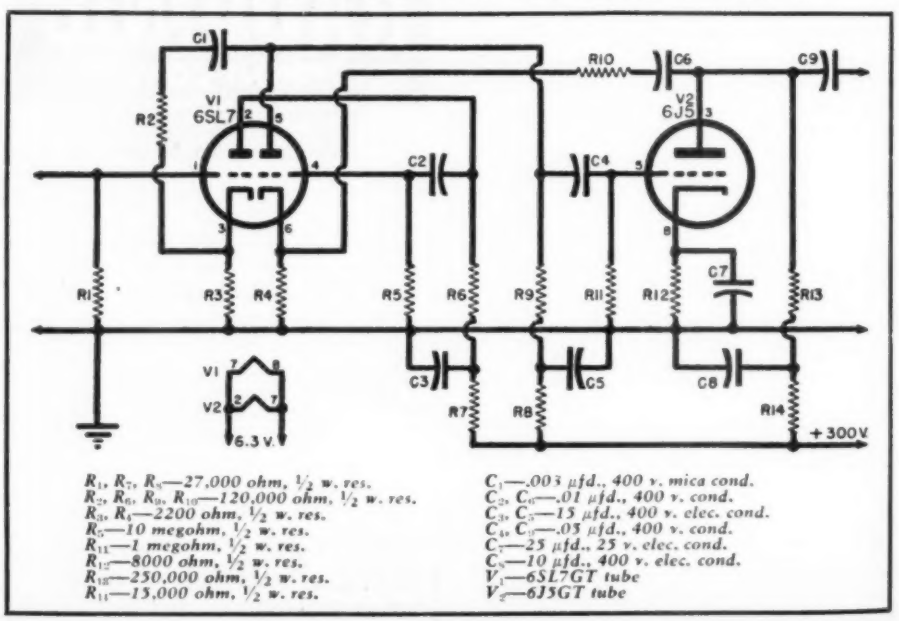
The output of this circuit is adequate to drive an ordinary amplifier and is remarkably clean. All parts fit into a chassis 7 by 3 by 1½ inches, bent from a sheet of galvanized iron. The placement of parts is not critical but care and the liberal use of spaghetti will reduce hum.

Regeneration is not noticeable at any usable room volume, but becomes severe at very high power. The high frequency response is controlled by the value of R_1 and in some cases dropping the value to 10,000 ohms may be desirable.

The design is such that an extra low frequency boost comes in at 100 c.p.s. although this may be varied by the value of C_6. Filament and plate power may be obtained from the associated amplifier power supply and grounding should be done close to the cathode of the first audio stage. To fully appreciate the value of this extra bass, try this circuit with a recording of a good drum solo.

—30—

Diagram of circuit for improving bass response of the G.E. magnetic pickup.



R_1, R_7, R_8—27,000 ohm, ½ w. res.
R_2, R_6, R_9, R_{10}—120,000 ohm, ½ w. res.
R_3, R_4—2200 ohm, ½ w. res.
R_5—10 megohm, ½ w. res.
R_{11}—1 megohm, ½ w. res.
R_{12}—8000 ohm, ½ w. res.
R_{13}—250,000 ohm, ½ w. res.
R_{14}—13,000 ohm, ½ w. res.

C_1—.003 μfd., 400 v. mica cond.
C_2, C_6—.01 μfd., 400 v. cond.
C_3, C_5—15 μfd., 400 v. elec. cond.
C_4, C_7—.03 μfd., 400 v. cond.
C_7—25 μfd., 25 v. elec. cond.
C_8—10 μfd., 400 v. elec. cond.
V_1—6SL7GT tube
V_2—6J5GT tube

15.330, 0215-0345 *(not* Mondays) to South East Asia with UN programs.

Poland—Despite the fact that *"Radio Polskie"* wrote Kary, Pa., some time ago disclaiming broadcasts on approximately 9.530 that were believed to come from Warsaw. Miss Dorothy Sanderson, Australia, has now received a reply to her report on these transmissions and the station confirms they *had* run tests on 31.48 meters. Heard there recently?

Portugal—CS2MF, 9.724, Lisbon, comes in well in Chicago in its daily 1900-2030 transmission to North America.

The Portuguese outlet on 15.100 broadcasts daily for Portuguese in Africa 1230-1530 in parallel with CS2-MK, 11,027, Lisbon. (Radio Australia)

Rhodes—Kary, Pa., has received verification from the portable mobile station with UN on Rhodes; call is 4UN, frequency of 14.996, and transmitter used was SCR 399 (U. S. Army), 400 watts, with whip antenna.

Roumania—Bucharest, 11.900, 9.520, has news 1500-1530. (Pearce, England)

Sweden—SDB-2, 10.780, and SBT, 15.155, have been good signals lately in the 1900-2000 program to North America, news at start; have DX session Saturdays at 2000. (Glenn, Pa.) The DX program is also heard well Saturdays 1000 on SBT, 15.155.

Switzerland — International Red Cross, 6.345, Geneva, has information news bulletin daily 1240, 1540. (Pearce, England)

European Service is heard on HE15, 11.715, and HER3, 6.165, Berne, 0400-0140 (Sundays) and daily 0020-0140, also at 1200-1700. *No English noted.* (Pearce, England)

Trinidad—Radio Trinidad, approximately 9.625, has improved signals early mornings; BBC news relay 0600. Has been heard in Australia with excellent signal. (Sanderson)

United States — WRUX, 25.600, is now scheduled on 25.600, 1100-1400, to Europe.

USSR—Radio Moscow's North American periods are announced for 0745-0815, 11.81, 11.88, 15.17, 15.39, 15.41, 17.83; 1820-1930, 11.71, 11.87, 11.88, 11.96, 15.23, 15 39; 1930-1950 *only* 11.71, 11.96. (McPheeters, La.)

The Moscow beam to Latin America is 2000-2029 in Portuguese (presumably for Brazil) and 2030-2230 in Spanish on (announced) 11.89, 11.72, 11.96, 11.63, 9.66. (Worris, N. Y.)

Petropavlosk, 6.070, has recently been one of the best signals in East in 49-m. band around 0530; easily recognized by poor modulation. (Kary, Pa.)

Huse, Washington, reports Khabarovsk, 8.820, with good signal 0400-0500, but has code interference, noise, and poor modulation; *no English noted.*

Fargo, Ga., reports *Radio Moscow* with an *English* session 1230-1330 on approximately 15.40. (This is probably beamed to Britain.)

Vatican—HVJ's 31-m. outlet has

moved from 9.660 to 9.640. (Fransson, Sweden)

Gillett, South Australia, has heard HVJ on approximately 15.100 calling Madrid at 1115.

Venezuela—YVKC, Radiodifusora Nacional de Venezuela, has notified Morgan, Pa., that "at present our programs are broadcast in Spanish but soon we shall begin transmissions in *English. We have purchased a RCA short-wave transmitter of 50 kw. power which will be installed soon.*"

YV5RM, 4.915, and YV5RN, 4.920, are in dual to closing 2030; Spanish *only.*

* * *

Last Minute Tips

Edward Bonong, chief engineer, *Radio SEAC*, Colombo, Ceylon, confirms to me that the 15.230 transmitter radiates with 7.5 kw. while the 15.120 outlet uses 100 kw. Current schedules are Main Program, 2330-0130 and 0530-1115 on 15.120, 17.730 (except between 0700-0715), 6.075, 9.520, 3.395; on Saturdays and Sundays transmissions begin at 1930; Ceylonese Forces Program, 0700-0715 on 17.730; the special Sunday transmission to Great Britain at 1230-1430 is carried on 15.120 and 17.770 to British Isles, and on 3.395, 6.075, and 9.520 to other areas (India, Asia, etc.). The 15.230 channel is used only for special broadcasts—such as the recent relay of cricket matches from the BBC, London.

The New Zealand Radio DX League lists XOPB, Chekiang, China, 12.120, 500 watts, 1930-2230, 0030-0930; XKPB, Shansi, 9.500, 200 watts, 1930-2030, 2200-2300, 0430-0955. (Cushen, New Zealand)

Laubscher, South Africa, has received a reply to his report to *Radio Diamang*, Angola; address is Director, Companhia de Diamantes de Angola, Dundo, Angola. *Radio Diamang* is operated solely for the entertainment and culture among personnel (company staff and diamond-mine workers). Is scheduled 1330-1430 daily and 0400-0500 Sundays; call is CR6RG and frequency is 8.242. Uses a locally-constructed transmitter pushing 300 watts into Zepp half-wave antenna. They so appreciated Laubscher's report that on August 21 they dedicated a special period of classical music (half-hour) to him, announced in *English* and presented outside regular broadcasting hours, that is at 1500-1530.

Latest Angola outlet reported by Laubscher is Radio Club de Bie, Silva Porto, Angola, on approximately 7.550, heard with strong signals 1200-1300. Laubscher points out, incidentally, that CR6RS is *not* Radio Clube de Angola but Radio Clube do Sul de Angola.

Anyone abroad wishing pen-friends through the *Swedish Radio* should write to "My Friend Abroad," Stockholm C, Sweden. (Skoog)

Sanderson, Australia, reports XNCR, Communist-controlled Chinese outlet on approximately 9.390, heard at 0615 with Chinese news followed by Western music.

Among frequencies being used by

Paris for relaying UN General Assembly broadcasts are 17.765, 11.845, 15.100. (Stibb, Wisc.) Transmitters are located 150 kms. from Paris.

Tashkent, Uzbek, USSR, 6.820, has extended its *English* service for the Far East, now broadcasts each Wednesday, Friday, Sunday at 1200-1230; station is heard well in Sweden, asking for reception reports and comments on programs. (Swedish DX Program)

Bandoeng, Java, is heard by Woodruff, Calif., on approximately 10.40 to closedown 1000.

Beirut, 8.030V, *"The Arab Voice of Lebanon,"* has *English* period now 1100-1140, news 1100. (Bluman, North Africa, via Radio Australia)

YDC, 15.150 (announced, but actually 15.145), Batavia, *Radio Indonesia*, is scheduled 0300-1300; *English* 0600-0700 to Australia; 1000-1100 in French to Indo-China; 1200-1230 French to Europe; 1100-1200 Dutch for Holland; 1230-1300 Arabic for Middle East; 0800-0830 Arabic. (Dilg, Calif.) Sometimes around 0925, 11.767 and 7.275 are in parallel.

Some time ago, *Radio Australia* announced that *Radio Athens* had been heard testing on announced 17.745 at 0900-0945, actually on 17.75, according to Herbert Bluman, North Africa; used Greek, French, *English*.

P. Jankowski, Radio Officer, European Office of the United Nations, Geneva, Switzerland, informs me that UN programs are scheduled in *English* daily at 1300 and 1600, followed each period by French language transmission; *not on Sundays;* each language takes 10 minutes. Russian is scheduled Mondays, Thursdays 1340-1350, and Polish is used those days 1350-1400. The *English* and French transmissions are carried on both 6.672 and 18.450, but the Russian and Polish transmissions are radiated on *only* 6.672. Mr. Jankowski comments that "We have been broadcasting regularly for about six months, and judging by fan-mail, have quite a considerable and faithful audience." In a letter to Kary, Pa., it was stated "Many people have said that they would like to hear news about international cooperation and about the United Nations, from a completely objective source. This is what *United Nations Radio*, Geneva, is trying to give them. We work with a small personnel and do not attempt to compete with larger broadcasting systems. By being absolutely impartial and friendly in its approach, *United Nations Radio* is trying in a modest way to provide listeners in many countries with reliable information about world affairs. Comments, criticisms, and suggestions are always welcome and should be addressed to United Nations Radio, Geneva, Switzerland. Callsigns are HBF for 18.450 and HBQ for 6.672.

PCJ, Hilversum, Holland, was heard testing recently to Indonesia at 0600 on 15.220, 17.775, 21.480. (Carlberg, Sweden)

Bluman, North Africa, has informed *Radio Australia* he has been hearing

Sharq-al-Adna (which he lists as now located at Amman, capital of Trans-Jordan) on 18.510; believed to be harmonic of 6.170. He says this station now uses a fourth channel, 9.650, in parallel ZJM5, 6.170, ZJM6, 6.790, and ZJM7, 11.720, to 1530 closedown daily.

Chavez, Cuba, reports Manta, Manabi, Ecuador, on 9.860 at 1930-2200, announcing "La Voz de la Democracia;" *all Spanish;* good level in Cuba but has CWQRM at times.

Our thanks go to Hans F. Breitbarth, a columnist for the widely-circulated newspaper, *"El Panama America,"* in Panama City, in encouraging through his column that Latin-American broadcasters use the *English* language more freely.

Huse, Washington, reports HLKA, measured 7.933.5, Seoul, Korea, at 0300-0715; *no English* heard except occasional station identification.

XEFT, 9.548, Vera Cruz, Mexico, generally has strong signals after 0000; news in Spanish at 0000; announces "XETF, La Voz de Vera Cruz" (medium-wave call). (Kary, Pa.)

Paris, 6.200, opens 0000 with news in French; Strong signal. The 9.550 channel parallels; 6.200 leaves the air 0015, but the 9.550 outlet leaves A carrier on to 0030 when begins again in French. Apparently 6.200 is used only 0000-0015 for this transmission. (Kary, Pa.)

The Forces Broadcasting Station, Cyprus, is heard by Kary, Pa., on measured 7.214.5 apparently opening 2200. Berkstrom, Sweden, says this is definitely JCKW, moved from Jerusalem, and now located at Nicosia; heard in Sweden at 1700.

Late tips from Balbi, Calif., include Bandoeng, 4.855, Java, 0800-0930, weak to fair; XGOA, 5.985, Nanking, fair 0500-0915; KZMB, 6.000, Manila, 0430-0930, bad CWQRM usually; Indo-China on 6.095, all French, 0830-0930, QRM bad at times; Chinese outlet on 11.850 at 0430 and later, weak to fair, may be XORA, Shanghai (?); CBFX, 9.610, Montreal, signs on 2300, replacing CBLX, 15.090; XGOY, 11.913, Chungking, has replaced 15.170 for 0830-1040 period. Balbi is hearing a station on

ELECTRON-RAY INDICATOR FOR DYNAMIC NOISE SUPPRESSOR

By ROBERT W. TIMMERMAN, W8YIF

A USEFUL addition to a dynamic noise suppressor is an electron-ray indicator tube such as those commonly used as "tuning eyes" in radio receivers. This tube can be made to indicate the opening and closing of both the high-frequency and low-frequency gate circuits. Ability to observe both of these variables continuously and simultaneously is very helpful in adjusting the circuits for optimum performance, and is advantageous in demonstrating the operation of the unit.

The type 6AF6G tube is actually a double vacuum-tube voltmeter, which indicates by the shadow angles on its fluorescent screen two independent voltages applied to the respective control electrodes. With zero voltage on a control electrode the corresponding shadow is a sector of approximately 90 degrees. Increasing the voltage between the control electrode and cathode causes the angle to decrease, until at about 160 volts the angle reaches zero and the "eye is closed."

A reactance tube, as used in the dynamic noise suppressor, is connected so that when the gate circuit is closed, the control grid voltage is near zero, the tube is conductive, and because of the high resistance (470,000 ohms) in the plate circuit the voltage at the plate is very low. As the gate is caused to open by increased negative grid voltage, the tube becomes less conductive, the plate current decreases, and the voltage at the plate increases. As the grid voltage approaches the value necessary to cause plate current cut-off, the potential at the plate of the tube approaches the supply voltage (250 v.). Therefore, to obtain an indication of the gate circuit conditions, it is necessary only to measure the reactance tube plate voltage. The circuit diagram (Fig. 1) shows how this may be done with the 6AF6G tube.

In order not to disturb the functioning of the reactance tubes, high-resistance measuring circuits are used. R_1-R_2 and R_3-R_4 constitute voltage dividers which limit the maximum voltage that can be applied to the control electrodes to a value just sufficient to close the eye. Slightly different values of R_2 and R_3 from those shown may be necessary in a particular installation. Closing of the sector should be checked with the suppression control switch in the "off" position. With the circuit adjusted for maximum suppression and no signal applied, the shadow angles should be at maximum, around 90 degrees. If the shadow angle remains small under these conditions, the reactance tube is not conducting as it should. If it is certain that the control grid voltage is correct (approximately zero), a slight adjustment in screen voltage may be required.

After a little practice the conditions and performance of the D.N.S. can be ascertained by a glance at the ray-tube patterns. The dynamic range is indicated by the magnitude of the shadow fluctuations. The absolute frequency range at any instant is also shown, wide angle indicating restricted range and narrow angle wide range. In addition to its value in adjusting the controls, the action of the shadows is quite entertaining, and vividly demonstrates the difference in time constants of the low-frequency and high-frequency control circuits. The high frequency indicator fluctuates rapidly, with each note of music; the low frequency indicator opens and closes only with the general trend of loudness.

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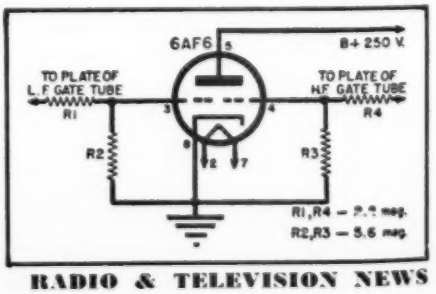
Fig. 1



9.840 at 0500-0930, bad CWQRM, announcing *"Radio Sario"* and *"Radio Nederlands;"* says may be Java. This one has been heard for some time by Stark, Texas, who believes it to be Menado, Celebes. *Can anyone confirm location?*

DAKU, 15.920, commercial transmitter formerly operated by *RCA Communications, Inc.*, now is owned and operated by *Press Wireless, Inc.* Has 7.5 kw. power using rhombic antenna; located in Germany. (Kary, Pa.)

German radio telephone channels to Argentina and Brazil operate daily on DFU, 17.520; DFB, 14.410, DFM, 19.460, and DLO, 19.975; telegraphy transmissions from Germany to various South American countries operate on DGM, 9.795; DFR, 15.593; DGQ, 20.500; DGJ, 13.375; DFV, 19.443, and DGS, 22.800. (Kary, Pa.)

The Control Commission in Germany now has a transmitter radiating the *Nordwestdeutscherrundfunk* programs from Hamburg on 7.290 with 50 kw. Antenna is an omni-directional for Europe; scheduled 2300-1730. (Kary, Pa.)

Karl Schwarz, Vienna, informs me the new Bogota station on 9.520 is heard in Austria at 1830-1930, good level. Karl also reports BFEBS, 15.300, Singapore, fine signal at 0930-1130 closedown.

Dilg, Calif., reports a station on 4.985 announcing *"Radio Malaya,"* location unknown; bad CWQRM; relays Singapore Red and Blue Networks, but when heard was *not* in dual with either Kuala Lumpur (approximately 6.030) nor Singapore's 4.825 outlet. At 0745 carries Malayan program and has *English* 0745-0900; fades out around 0930. Station heard by Dilg on 4.845 is believed to be Medan, Sumatra, probably moved from 7.210; takes relay from Holland 0800 and Dutch news from Batavia at 0900. Dilg flashes that XNNR is at Harbin, Manchuria, on measured 7.098, scheduled 0500-0935.

* * *

Acknowledgement

Many thanks for the fine reports coming in. A new DX season is just getting under way for many readers. May it be a successful and profitable one! . . . K. R. B.

AM-FM Receiver

(*Continued from page* 64)

quired for a stated output gives the transfer impedance of the first i.f. transformer. The deviation of this value from the value obtained with subsequent circuits heavily loaded gives an indication of the amount of feedback present, insofar as the first i.f. transformer is involved. In the receiver described, the indicated transfer impedance changes from 7050 ohms to 6500 ohms when the plate winding of the second i.f. transformer is shunted with a resistor of 5100 ohms. The amount of feedback required to produce this change is considered small enough to be satisfactory.

The primaries of the i.f. transformers for both AM and FM are connected in series, but in the FM position, the AM winding for the first i.f. transformer is short-circuited. In the AM position, it was noted that a considerable d.c. voltage develops across the electrolytic stabilizing condenser of the ratio detector at a number of discrete frequencies. Investigation showed these frequencies were amplified harmonics of the AM oscillator frequency and corresponded to oscillator frequencies of one-fifth, one-sixth, etc., of 10.7 megacycles. The AM performance did not seem to be impaired, but it may be preferable to arrange the switch to short-circuit or disconnect the FM i.f. transformer winding when the AM system is in use.

From Fig. 2, it can be seen that the oscillator-grid circuit of the 12BE6 is switched to change from FM to AM. The diagram is shown for the FM band. The oscillator circuit for FM is of the Colpitts type to avoid switching the cathode. In an earlier design in which a Hartley-type oscillator circuit was used for both AM and FM, considerable difficulties with parasitic oscillation were experienced in trying to switch the cathode lead. A trifilar choke, consisting of three wires twisted together and then wound as a coil, provides impedance to ground for the catnode and the two heater leads. The ratio of the internal capacitance between cathode and screen grid to the capacitance between oscillator grid and cathode determines the feedback. It was found that when a small amount of capacitance is added between cathode and oscillator grid, the oscillation is increased. Use of a 4.7 $\mu\mu$fd. condenser gives a minimum d.c. voltage at the oscillator grid of 3.5 volts, a plate current of 1.9 milliamperes, and a screen current of 7.5 milliamperes. The sensitivity can be increased 10 per-cent by omitting the external grid-to-cathode capacitance, but the added margin of safety obtained by maintaining the higher oscillator voltage is considered more important than the improvement in gain.

Operating the heater and cathode of the converter tube at the same r.f. potential avoids microphonics caused by variations of heater-cathode capacitance due to vibration. The resistance in the signal grid of the 12BE6 is kept low so that any grid current will not bias the tube and thus reduce the conversion gain.

For both FM and AM the oscillator is operated at its fundamental frequency which is above the signal frequency. The FM tuning range is 86 to 111 megacycles and the AM range is 530 kilocycles to 1620 kilocycles.

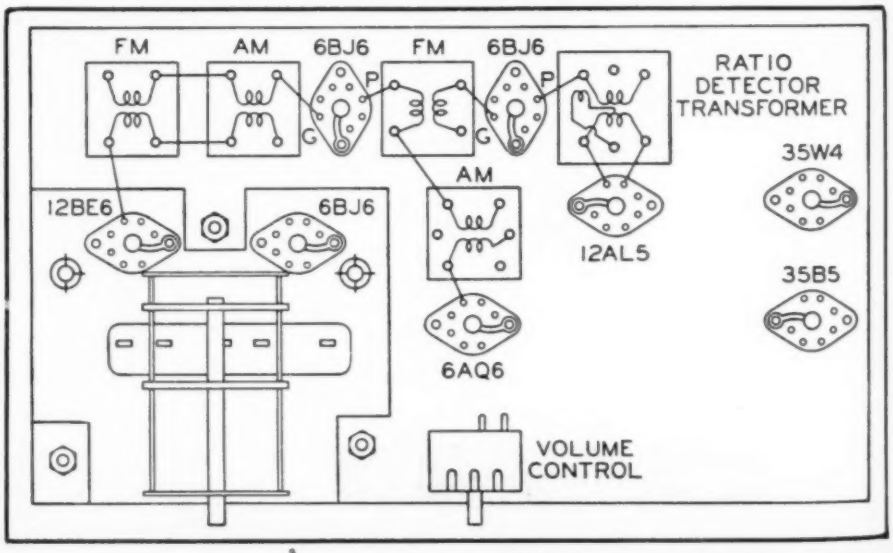
The r.f. stage is tuned for the FM band and untuned for the AM band. The wafer switch simply connects the FM tuned circuit in parallel with the AM untuned circuit. An AM i.f. trap is included as part of the AM interstage circuit.

The grid of the 6BJ6 r.f. amplifier is switched from the AM tuned input circuit to the FM tuned input circuit. The FM antenna winding is coupled closely to the FM r.f. coil.

Gain and Noise Measurements

The over-all gain of the r.f. and converter unit at FM frequencies can be defined as the ratio of the i.f. volt-

Fig. 4. Mechanical layout of chassis viewed from the bottom.



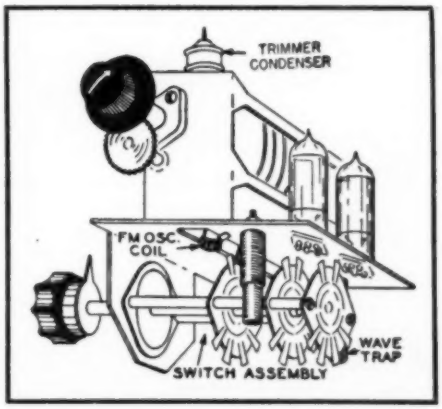
age at the first i.f. grid required to produce a specified output to the r.f. input voltage required to produce the same output. The r.f. input voltage is measured at the signal generator terminals with a 300-ohm dummy antenna connected between the generator and the antenna terminals of the receiver. The value obtained by dividing the current input required at the converter plate by the voltage r.f. input is a better index of r.f. unit performance, because the first i.f. transformer is thus excluded. Neither measurement, however, can give information about the performance of the separate stages and the individual components used. The procedure used to obtain this information follows.

An r.f. signal is introduced at the signal grid of the converter through a 300-ohm resistor and an adjustable series condenser. The condenser consists of two lengths of hookup wire twisted together. Fig. 6 is a sketch of this arrangement with the equivalent circuit applicable to the type of measurement discussed. The series condenser is adjusted to the value requiring the minimum input for a given output by twisting, untwisting, and cutting the wires. The amount of capacitance used may be measured, and from this value the approximate conductance reflected from the 300-ohm resistor can be computed. This data is useful in pointing out excessive circuit losses. This measuring technique has the advantage that the input required for a given output does not depend critically on the point at which the condenser is connected. Estimates of conductance made by this method do, however, apply to the specific connection points.

The same method may be used to introduce a signal into the grid circuit of the r.f. tube. Comparison of the input required for such a test with the input required when the signal is introduced through the antenna terminals gives information as to the efficiency of the antenna coupling circuit provided.

Performance data for the r.f. unit is given in Table 3. Data for the FM band was obtained by the method described. Conventional methods were followed in obtaining the AM data. A uniform gain of 4 for the 12BE6 con-

Fig. 5. Sketch of r.f. sub-assembly.



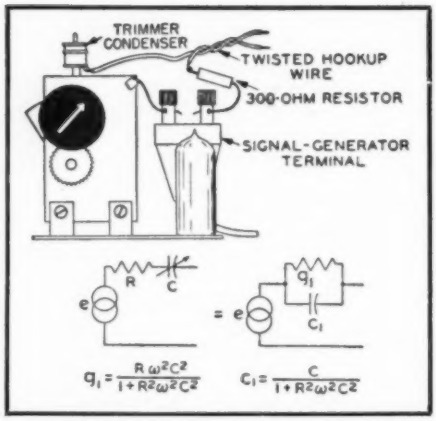


Fig. 6. Setup for making r.f. measurements.

verter is obtained over the FM band. The over-all FM front-end gain measured with a 300-ohm dummy antenna varies from 24 at 105 megacycles to 28 at 90 megacycles.

Receiver noise in the FM band was measured by determining the signal input at which a change from zero to 30 per-cent frequency modulation increases the audio power output by 30 db. The required signal level at 96 megacycles is 31.0 microvolts. In the AM band, the equivalent-noise-sideband input is 3.1 microvolts per meter at 1000 kilocycles.

Frequency Stability

The oscillator frequency drift during the first 15 minutes of chassis warm-up is 75 kilocycles at a signal frequency of 100 megacycles. Compensation for this drift can be effected by connecting a 5 $\mu\mu$fd. condenser having a negative temperature coefficient of 750 parts in a million per degree C between the screen-grid terminal and oscillator-grid terminal of the 12BE6 socket.[2] With this compensating condenser, the warm-up drift is reduced to approximately 20 kilocycles. These tests were made with the receiver in the open, so it is probable that further adjustments would be required to obtain compensation when the receiver is in a cabinet.

Conclusions

The problems encountered in the construction of this a.c.-d.c. receiver were not too much different from those of an a.c. design. The 6BJ6 tubes give good performance in the r.f. and i.f. stages. The current required for the receiver is below the maximum rated value for the 35W4 rectifier and the rectified voltage obtained is sufficient to give satisfactory operation of the 12BE6 and 6BJ6 tubes. The 12BE6 can give as good performance in a circuit which includes high-frequency switching as it can in a circuit without switching. The circuit and the physical layouts must, however, be such as to permit short leads; the penalty for failure to observe this precaution is low gain and, frequently, parasitic oscillations.

As to whether an a.c.-d.c. receiver

[2] RCA Application Note No. 122, "Compensation of Frequency Drift."

for both AM and FM reception will cost less to manufacture than an a.c. AM-FM receiver the answer is problematical, but there is no doubt that both will cost considerably more than a receiver for the AM broadcast band alone. An a.c.-d.c. AM-FM receiver does have the features of being smaller in size and lighter in weight than an a.c. receiver employing a power transformer.

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SCHONING NEW RPEES PREXY

WILLIAM O. SCHONING of Lukko Sales Corp., Chicago was elected president of the Radio Parts and Electronic Equipment Shows, Inc., sponsors of the annual Radio Parts Show. Robert C. Sprague, Sprague Electric Co., North Adams, Massachusetts was elected vice-president; John L. Robinson of Croname, Inc., Chicago was named secretary, while Walter W. Jablon of Espey Mfg. Co., New York will serve as treasurer.

Mr. Schoning represents NEDA on the board, Mr. Sprague represents RMA while Mr. Robinson and Mr. Jablon represent the Association of Electronic Parts and Equipment Manufacturers and Sales Managers Club, Eastern Division, respectively.

Other directors elected include Jerome J. Kahn, Standard Transformer Corporation (RMA); Les A. Thayer, Belden Mfg. Co. (EP&EM); Aaron Lippman, Aaron Lippman & Co. (NEDA); Charles Golenpaul, Aerovox Corporation (SMED); and Lew Howard, Triad Transformer Co. (WCEMA).

The Show Corporation confirmed a four-day Show plan for 1949 at the Stevens Hotel in Chicago to run from Tuesday, May 16th through Friday, May 19th. On Thursday, May 18th, the Show Corporation will join with the Radio Manufacturers Association in an all-industry dinner to honor RMA's twenty-fifth anniversary. Leslie F. Muter of the Muter Co., Chicago, was named a guest member of the Show Committee's banquet and publicity committees to facilitate arrangements for the dinner program.

The Board also voted to recommend to the sponsoring groups that the 1950 trade show be held at the Hotel Waldorf-Astoria in New York.

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"Are you sure that television serviceman has left?"

AFCA NEWS

This Association is a patriotic non-profit organization, with chapters in most of the larger cities, dedicated to developing and maintaining efficient personnel, commissioned, enlisted, civilian, for the supply (including design and development), installation, maintenance and operation of communications and electronic equipment for Army, Navy and Air Force and their supporting civilian activities. It publishes a magazine "SIGNALS" at its national headquarters in Washington. Every American interested in any way in communications is eligible and invited to join.

AFCA News

1949 Convention

Initial plans for next spring's annual meeting were made at a conference held on September 9th. Present were: General S. H. Sherrill, AFCA Executive Secretary; Admiral Earl E. Stone, Chief of Naval Communications; Admiral Edward C. Ewen, Chief of Naval Public Realtions; Capt. Robert Foley and other members of their staffs; Mr. Frederick G. Macarow and Col. E. C. Cover, President and Secretary of the Washington Chapter which will be host to the convention.

Amateur Radio Organization

Lt. Col. George R. Call of Sioux City, Iowa, appointed last May as chairman of the AFCA committee to study the possibility of radio "hams" being better organized for an emergency, has submitted his first report and has made two visits to Washington to gather necessary information. On August 25th and 27th he conferred with the Executive Secretary and with officials of the Army, Navy, and Air Force.

September "Signals"

This issue of AFCA's magazine was dedicated to the Navy in honor of Navy Day, October 27th. It included articles on the Navy Electronics Laboratory, Coast Guard communications, the Marines' code talkers, Navy communications training, and other interesting articles.

Chapter Notes

European

On August 14th, 168 members and guests of the European Chapter boarded the yacht "Gutenberg" at Frankfurt and attended the second quarterly meeting of the chapter which was combined with an eight hour cruise of the Main and Rhine Rivers. Major General Jerry V. Matejka, Chief Signal Officer of EUCOM, addressed the members and commended the progress being made by the chapter.

A European Advisory Committee, to represent the three services, was appointed as follows: Col. R. W. Raynsford, Army; Col. D. C. G. Schlenker, Air Force; and Commander R. B. McCurdy, Navy. Representation on the Membership Committee was extended to include the Air Force; OCSigO, EUCOM; Frankfurt Signal Office; Constabulary; 1st Division; and the Navy. It was decided to extend guest membership in the European Chapter to Generals Clay, LeMay, Keyes, Milburn, Huebner, White; Admiral Schuirmann; Ambassadors Murphy and Erhart; and the Post Commanders and Commanding Officers of the Naval Advance Base at Bremerhaven.

Los Angeles

The initial meeting to form a Southern California Chapter of AFCA was held on October 15th at 8 p.m. at KMPC Studio A, 5939 Sunset Boulevard, Los Angeles. The meeting was preceded by a dinner at the Palms Grill. The main speaker was Capt. Harry C. Butcher, Naval Aide to General Eisenhower and author of the book, "My Three Years with General Eisenhower."

Richmond

Officers and committee chairmen of the Richmond Chapter met on September 9th to formulate plans for fall activities. The first dinner-meeting of the chapter was held on October 12th. General S. H. Sherrill, National Executive Secretary, came down from Washington to address the members.

Sacramento

The Board of Directors of the Sacramento Chapter met on August 25th at the Sutter Club. Present were: Lt. Col. Wesley E. Calkins, McClellan Field, Air Force Counsel; Milton G. Mauer, Div. of Commercial Engineers, *PT&T;* Paul Carrington, *PG&E;* Robert D. Livingston, President, Junior Chamber of Commerce; George H. Brereton, Chief, State Div. of Identification; Waldeman E. Doyal, Sierra Camera Club; George H. Melvin, Executive Secretary, Sacramento Chapter; and H. M. Skidmore, Public Information Officer, Sacramento Signal Depot. Col. Stewart W. Stanley, Commanding Officer of the Sacramento Signal Depot, who attended as a special guest, was appointed Signal Corps Counsel for the Chapter.

Seattle

The Seattle Chapter held a dinner meeting on August 5th at the American Legion Hall. The speakers were Col. Fred Andrews, former Commanding Officer of the Alaska Communication System, and Major Joyce B. James of ACS. The feature of the evening

was a talk and demonstration on Micro-wave Phenomena presented by Mr. J. Key, Demonstration Supervisor of the *Pacific Telephone & Telegraph Company.*

Spanish War Veterans Division

The officers of the Spanish War Division of the U. S. Veterans Signal Corps Association have accepted an invitation to become an honorary division of AFCA. The U. S. Veterans Signal Corps Association was organized by Signal Corps veterans of the Civil War in 1867. The Civil War Division was disbanded in 1919 and the Association has been continued in existence by the Spanish War Division, which was organized in 1899.

There are some 300 members of this Association throughout the United States, of whom about thirty attended the annual encampment of the United Spanish War Veterans in Washington, August 22nd to 26th. At the Veterans luncheon at the Hotel Hamilton on August 24th, John White of Dallas, Past Commander, United Spanish War Veterans, was the principal speaker. Col. E. C. Cover, Secretary of the Washington Chapter of AFCA, spoke concerning the activities of his chapter, and Brig. Gen. S. H. Sherrill, Executive Secretary of AFCA, addressed the delegates, outlining the aims and purposes of AFCA, and extended the invitation for the Spanish War Signal Corps Veterans to become an honorary division. Officers of the Spanish War Veterans Division, AFCA, were elected as follows: Asa T. Pierce, Commander, and George A. Marshal, Adjutant.

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SHIELDED WIRES

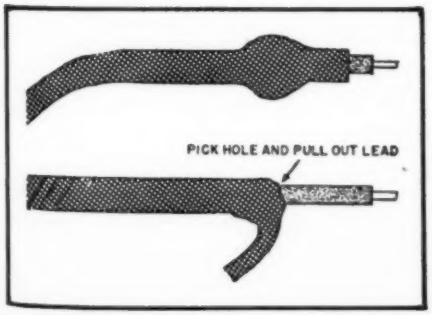
BY FREDERICK BAUER

TO make a neat end on shielded wires, that is, to separate the shield from the wire near the end which is to be connected, the following technique can be used.

First, push the shield back so that the bulge is about where you wish to have the point of separation. Next, bend both the shield and wire almost double. Now, with an ice pick or other sharp pointed tool enlarge a hole at the top of the bulge sufficiently to allow the double wire to be pulled out through the side of the shield.

The shield and wire can then be straightened out, leaving a neat end to be connected to your equipment.—30—

Method of preparing a shielded cable in order to make a neat and safe connection.



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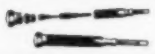

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ERRATUM

In the article "A Portable, Lightweight, 1-Tube Stroboscope" by Rufus P. Turner, appearing on page 38 of the September issue, the strobotron tube used in the instrument was given as a type 2D21. This is in error and should be the type 1D21. Our thanks to Sylvania Electric Products Inc. for calling this matter to our attention.

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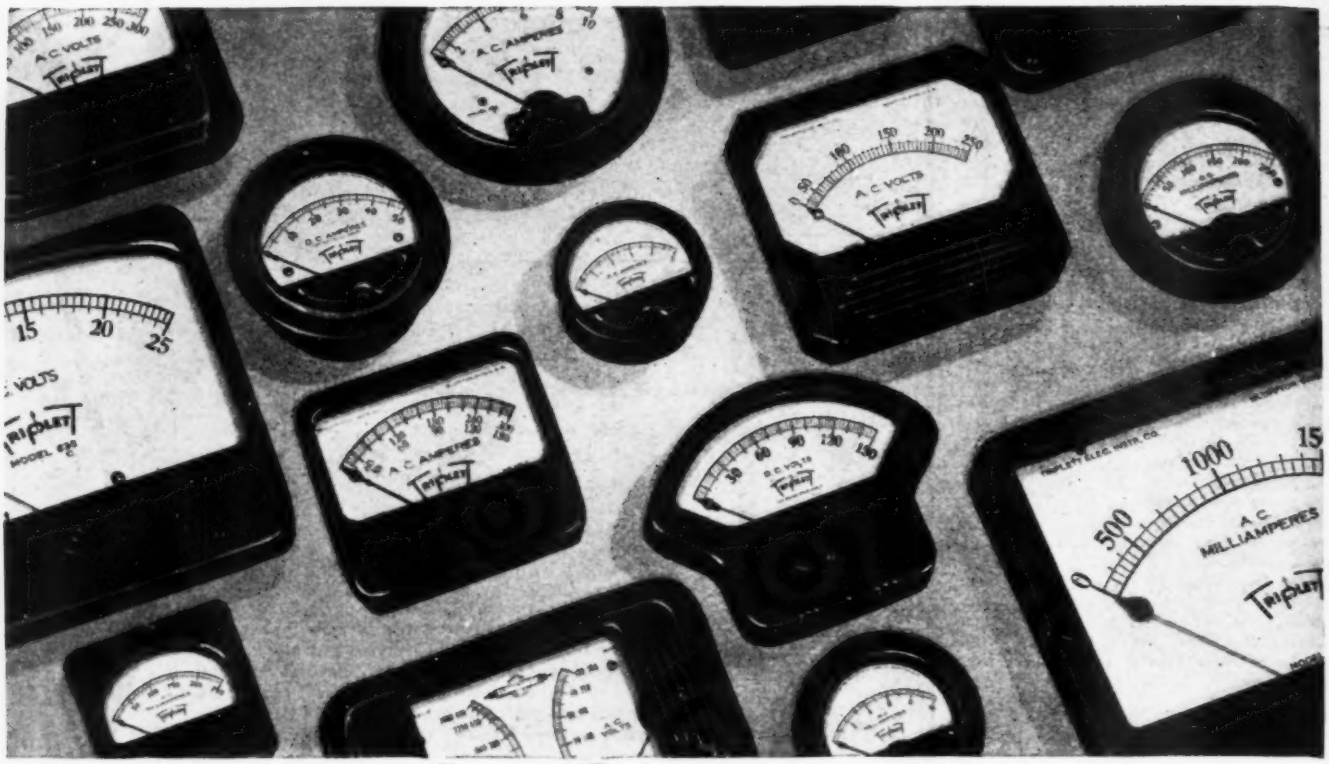

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